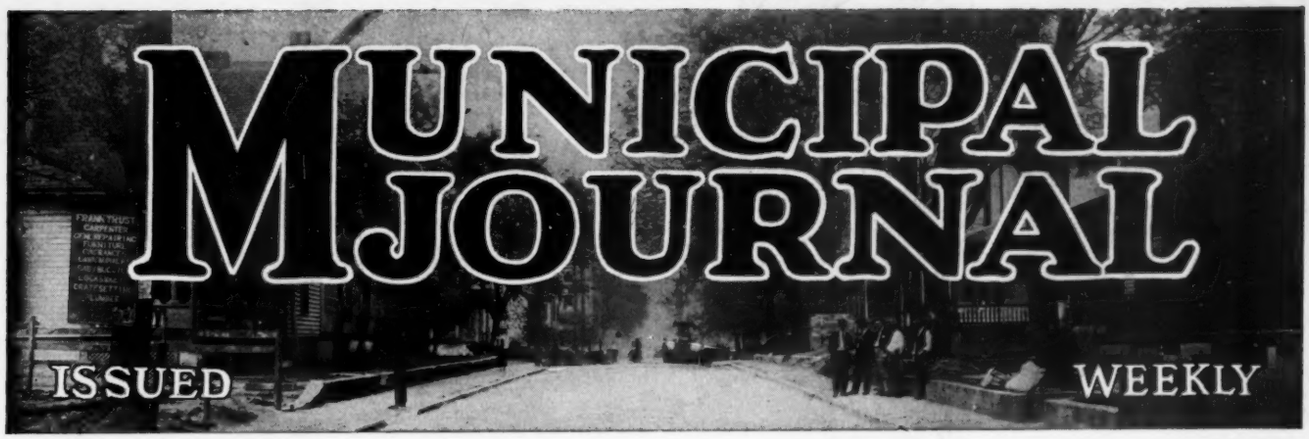

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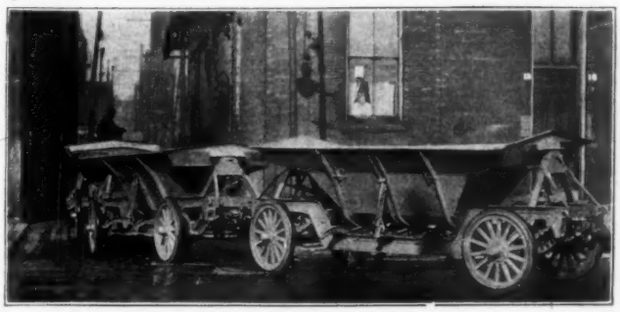

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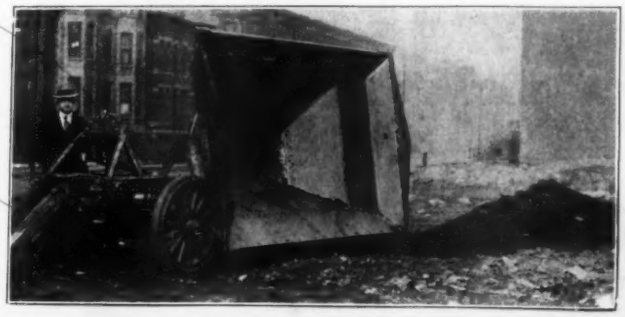

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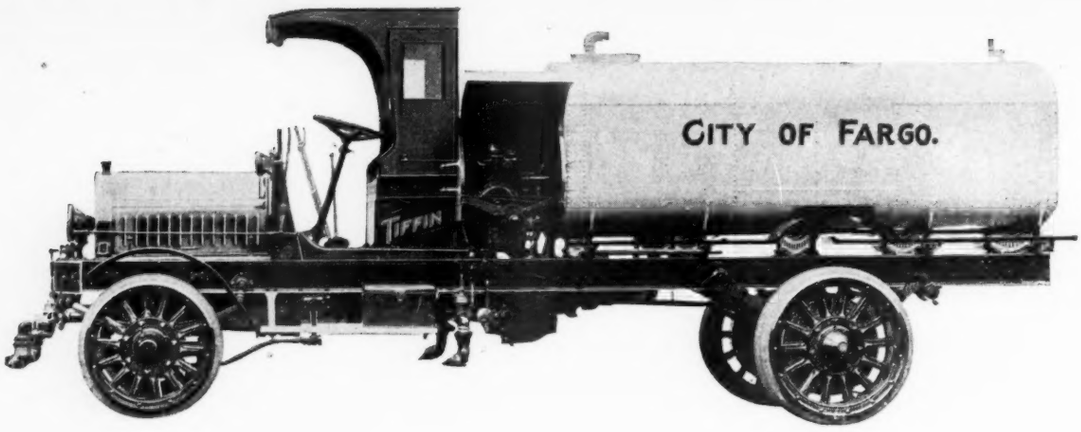

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Published Weekly by MUNICIPAL JOURNAL & ENGINEER, Inc., at 243 West 39th Street, New York

S. W. HUME, President. J T. MORRIS, Treasurer and Manager. A. PRESCOTT FOLWELL, Secretary

Subscription Rates:

United States and possessions, Mexico and Cuba.....$3.00 per year All other countries .....$4.00 per year

Entered as second-class matter, January 3, 1906, at the Post Office at New York, N. Y., under the act of Congress of March 3, 1879.

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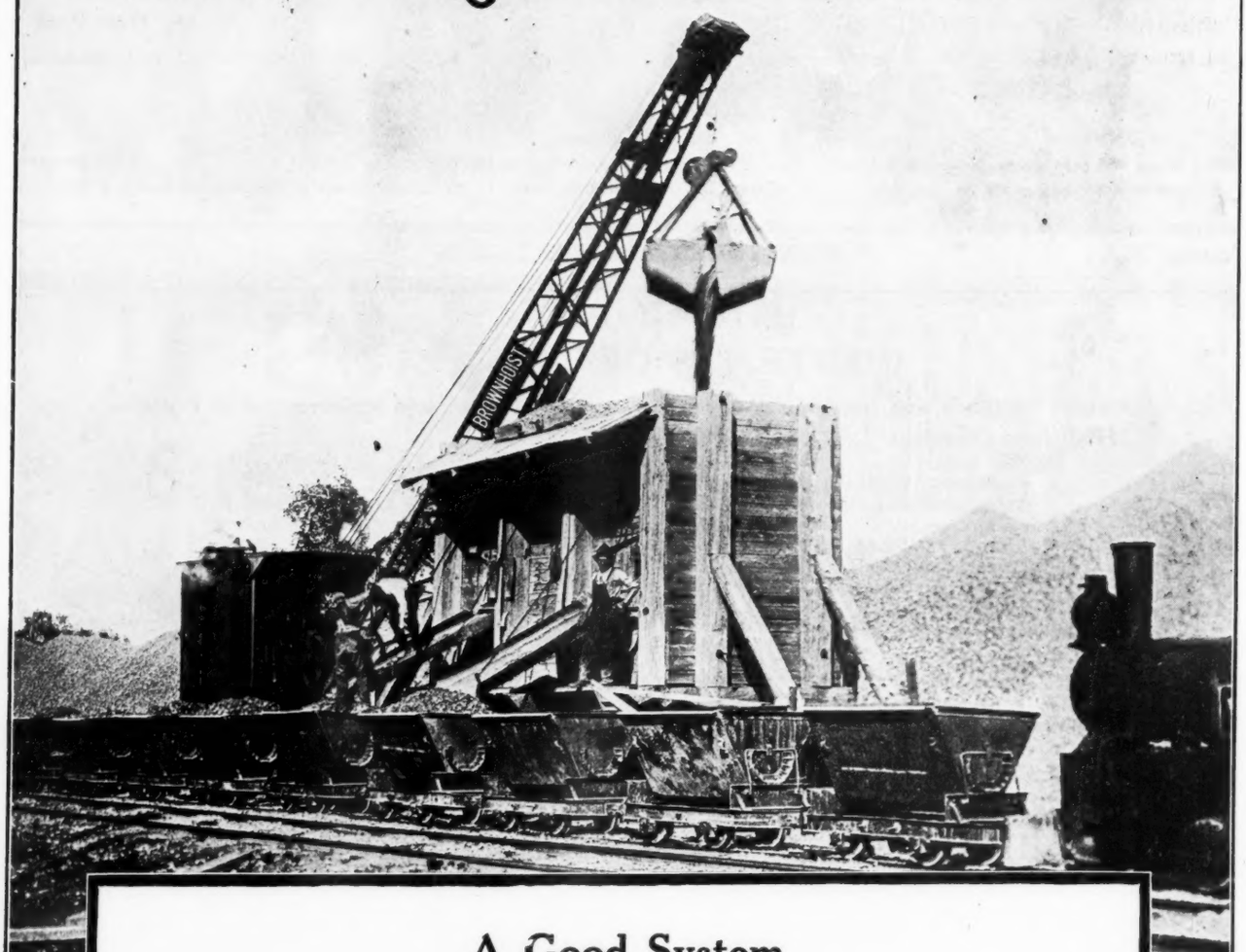

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AMERICAN METHODS AND MACHINERY APPLICABLE TO CONSTRUCTION AND MAINTENANCE OF FRENCH HIGHWAYS

An Article the Object of Which Is to Assist Engineers in France in Restoring the Roads That Have Been Worn Out by War Traffic or Destroyed by the Enemy.

By ARTHUR H. BLANCHARD,*

The highways of France represent an asset that any commonwealth in the United States would be proud and thankful to possess after millions of dollars had been expended upon its system of highways. It is well, upon the dawn of an era of unprecedented highway improvement in the United States, to take sober counsel and consider the reasons why the financial investment in the highways of France has resulted in a dollar's worth of highways being secured for every dollar expended. Briefly summarized, the admirable record credited to French engineers may be attributed to the following influential factors:

1. No political influence in the selection of men placed in the control of highway work, and no interference by bodies of laymen with the legitimate work of the highway engineer.

2. Appointment of thoroughly educated and trained highway engineers of long experience to responsible administrative and engineering positions in the Nationale, Departement, Arrondissement and Canton highway departments.

3. A source of supply of thoroughly educated highway engineers through the medium of the Ecole Nationale de Ponts et Chaussees.

4. The desired esprit de corps in highway organizations due to promotions based on merit and continuation in office of highway engineers who have rendered faithful and efficient service.

5. Concentration of responsibility in the supervision of highway work; a military organization of interrelated responsibility being characteristic of the Departement National de Ponts et Chaussees.

A large percentage of the highways under consideration have waterbound broken stone roadways, many of which have been surface treated with tar. In the northeastern part of France hundreds of miles of broken stone

*M. Am. Soc. C. E., M. Société des Ingénieurs Civils de France. Consulting Highway Engineer, New York City.

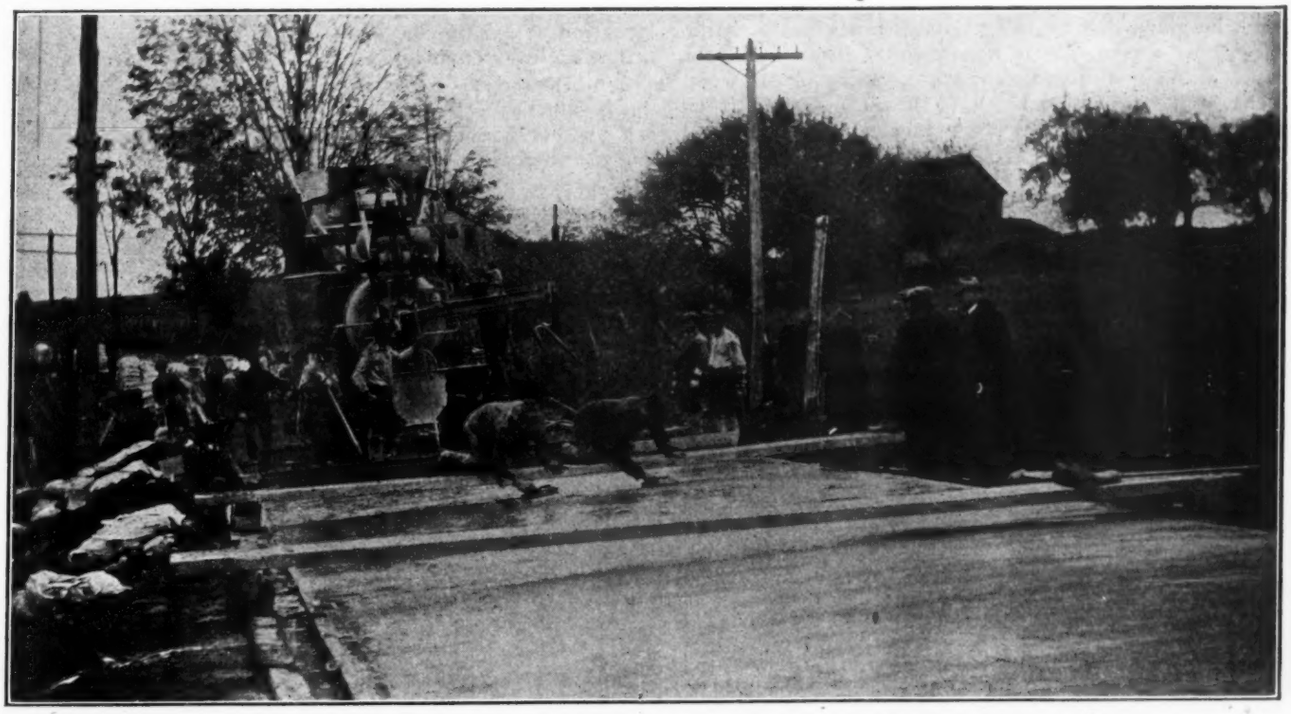

FIG. 15—METHOD OF FINISHING CEMENT CONCRETE PAVEMENT.
"Floats" used from plank "bridge."

roadways have been worn out by excessive traffic or have been destroyed by the ravages of war. In other sections the transportation of troops and supplies have subjected the roadways to abnormal traffic, primarily due to the vast increase in the tonnage carried and the large number of motor trucks used by the armies and for general transportation purposes. It is evident, therefore, that the French engineers will have opportunity to economically employ new methods of construction in those cases where the roadways have been worn out or destroyed. Because of loss of man power and the necessity for rapid restoration of roads worn out by war service, there would seem to be greater need than ever in France for the use of labor-saving machinery, which class of machinery has, it is believed, been developed to a greater degree by American practice than by French.

In considering the reconstruction problems confronting the French engineers, it is essential that the fundamental economic principle of efficient use of local materials be given due consideration. France has at hand, or within reasonable transportation distances, sand, gravel, broken stone, cement, tar, rock asphalt, wood blocks and stone blocks. Of these materials, rock asphalt, wood blocks and stone blocks will be omitted from consideration, as their use in pavements has been efficiently developed by the French municipal engineers.

The types of roadway surfacings which will prove of widest adaptability to the French engineers, will be water-bound broken stone with a thin surface treatment of tar, bituminous concrete, cement-concrete, and stone block. All of these types may be constructed of the materials found in France or of those which are easily accessible. The economic utilization of the roadway surfacings mentioned will depend upon the suitability of the type for the probable traffic and other local conditions.

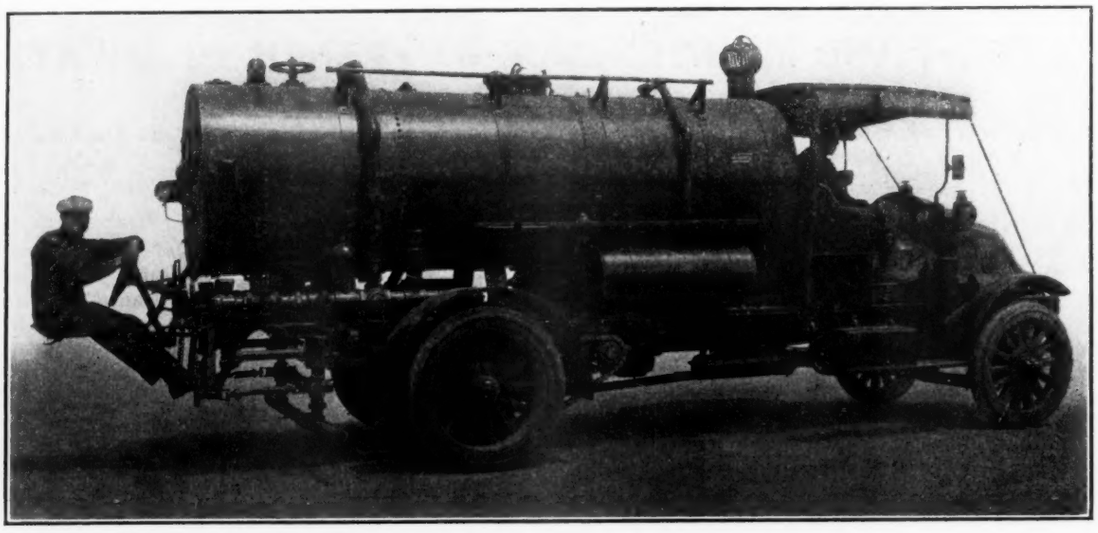

FIG. 1—KINNEY MOTOR TRUCK PRESSURE DISTRIBUTOR.

6. The design and construction of highways based on sound fundamental principles of proper location, alignment and grades, adequate widths of roadway and right-of-way, and efficient drainage and foundations.

7. Continuous maintenance by a thoroughly trained and efficient organization of patrolmen.

8. Economic and efficient methods of financing the construction and maintenance of highways.

The highway engineers of the United States have made notable progress in the development of many types of roads and pavements not commonly used in France, while American manufacturers may be credited with having placed at the disposal of engineers efficient machinery which far surpasses in variety, wide range of adaptability, and standardization of parts, the output of any other

FIG. 2—PRESSURE DISTRIBUTOR IN SERVICE.

FIG. 3—FILLING MOTOR TRUCK PRESSURE DISTRIBUTOR FROM RAILWAY TANK CAR.

country. Because of these factors, a presentation of some conclusion, based on American practice, may be of value to French highway engineers.

In presenting suggestions relative to the adaptation of American methods and machinery to the reconstruction and maintenance of the highways of France, the writer approaches the subject with hesitation born of inbred respect and admiration for the work of the Department Nationale de Ponts de Chaussees, many members of which the writer has become acquainted with during several sojourns in France.

This discussion will be confined to the highways of France outside of urban districts.

WATER-BOUND BROKEN STONE ROADWAYS WITH THIN SURFACE TREATMENTS OF TAR.

French engineers have little to learn from American practice with reference to the construction of water-bound broken stone roadways. Two suggestions will be offered pertaining to tar surface treatments.

First: refined tar should always be employed and it should be purchased under specifications covering its essential properties for highway work. The adoption of

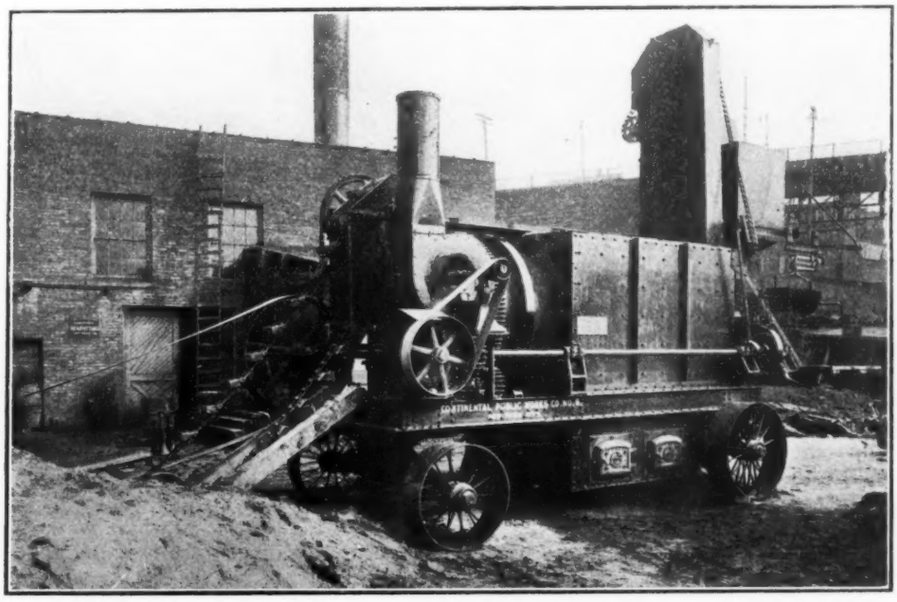

FIG. 4—BITUMINOUS CONCRETE MIXING PLANT. "CUMMER" PORTABLE PLANT.

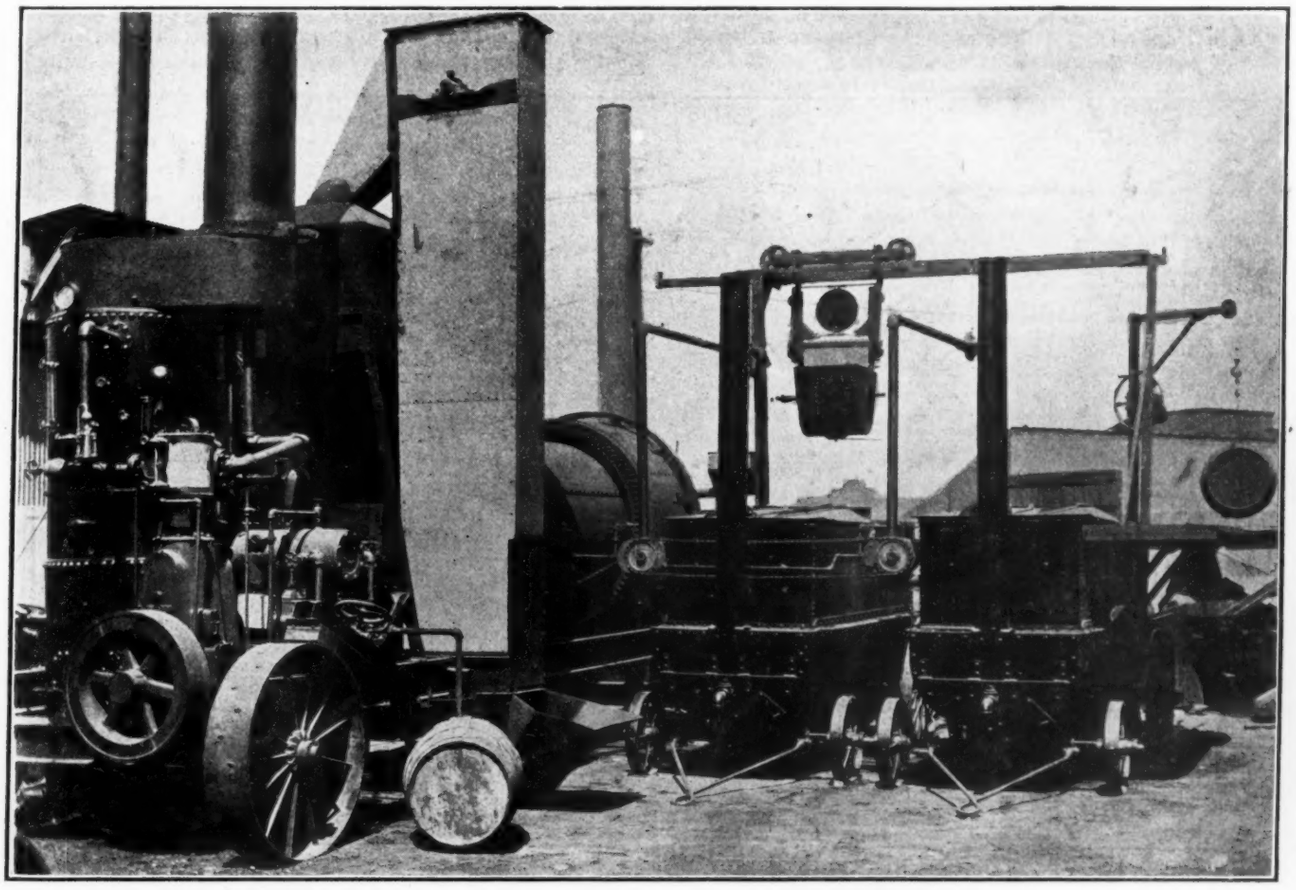

FIG. 5—WARREN BROTHERS' PORTABLE MIXING PLANT.

this recommendation will insure the use of a refined tar which is uniform in quality and of the most suitable grade for surface treatment work. It should also be noted that unheated refined tar of proper consistency is being successfully used in the United States, especially for the retreatment of tar surfaces.

been adopted by the American Society for Municipal Improvements:

"The pressure distributor employed shall be so designed and operated as to distribute the refined tar specified uniformly under a pressure of not less than 20 pounds nor more than 75 pounds per square inch in the

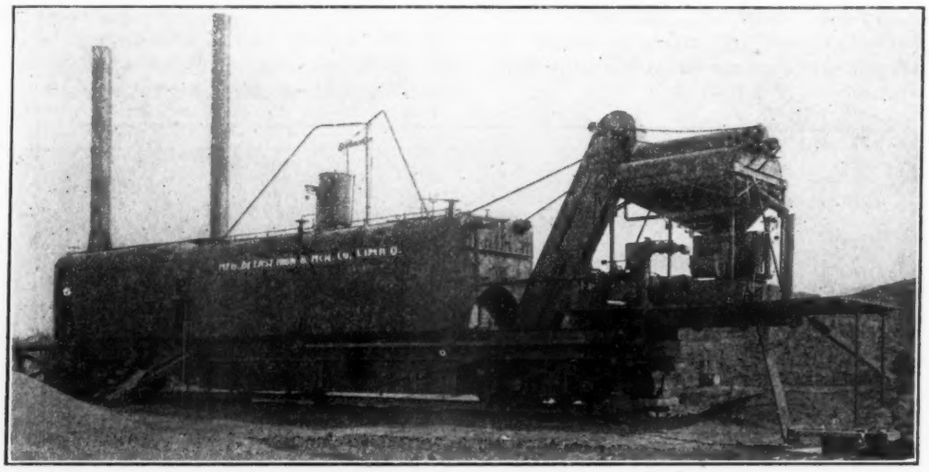

FIG 6—RAILROAD MIXING PLANT. EAST IRON COMPANY'S "MERRIMAN" PLANT.

Second: motor truck pressure distributors of eight to twelve hundred gallons capacity (see Figs. 1, 2 and 3) should be employed for the distribution of the tar in many sections of France. Small gravity and pressure distributors will not be discussed, as French manufacturers have for many years supplied efficient machines of this class. The large mileage of broken stone roadways in France insures that the use of large-capacity distributors will be especially economical and efficient. There are several types of such machines in common use in the United States, the essential features of which are covered by the following specifications which have

amount and between the limits of temperature specified. It shall be supplied with an accurate stationary thermometer in the tank containing the refined tar and with an accurate pressure gage so located as to be easily observed by the engineer while walking beside the distributor. It shall be so operated that, at the termination of each run, the refined tar will be at once shut off. It shall be so designed that the normal width of application shall be not less than 6 feet and so that it will be possible on either side of the machine to apply widths of not more than 2 feet. The distributor shall be provided with tires of widths dependent upon the following

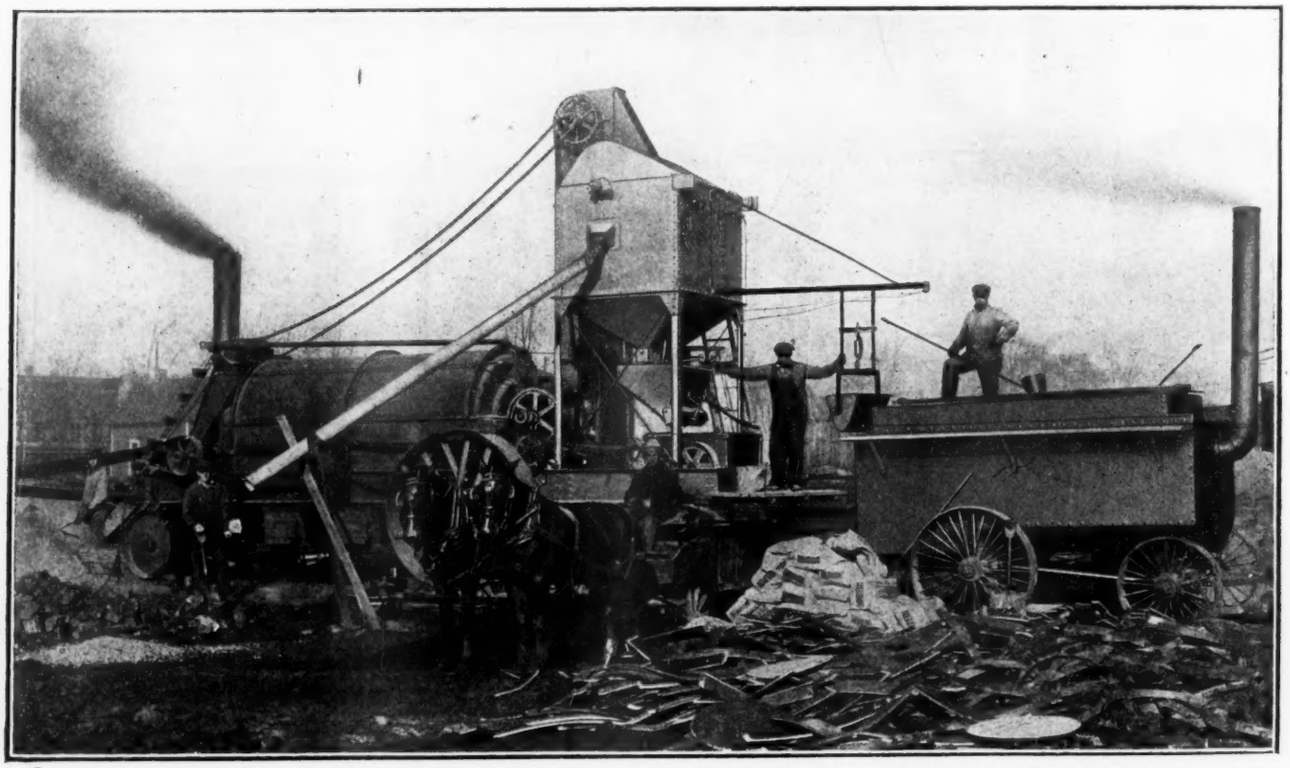

FIG. 7—MIXING BITUMINOUS CONCRETE WITH HETHERINGTON & BERNER PORTABLE ROAD PLANT NO. 5.

relationship between the pressure per square inch of tire and the diameter of the wheel; for a 2-foot diameter wheel, 500 pounds shall be the maximum pressure per linear inch of width per wheel, an additional pressure of 30 pounds per inch being allowed for each additional 3 inches in diameter."

Some American distributors efficiently utilize pressure from air compressors. Steam is delivered to the compressors either from a boiler mounted on a distributor or from steam roller or tractor. By the passage of

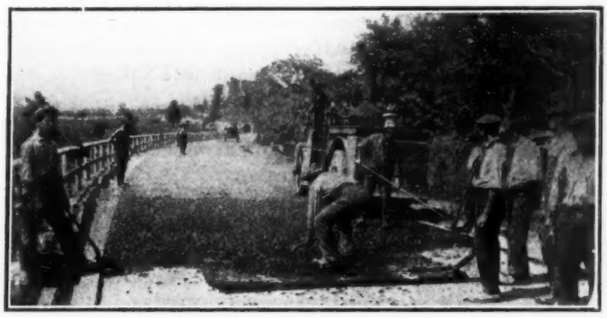

FIG. 8—SPREADING AND ROLLING CLASS A BITUMINOUS CONCRETE.

steam through a system of pipes, the bituminous material is heated to the desired temperature. The material is distributed through either one or two horizontal pipes equipped with nozzles. Several pressure machines equipped with mechanical power pumps have been invented in the United States. The distributing devices of all of these machines are alike in having horizontal pipes fitted with nozzles. The machines differ somewhat in the way the pressure is obtained and applied. Pumps, run by a sprocket-drive attachment on the rear axle, by steam, and by gasoline, are utilized. Horses and steam rollers are used for hauling some distributors, while others are mounted on motor truck chasses.

The following factors should be given consideration when selecting a pressure distributor: (1) Character and range of work upon which the distributor will be used; (2) present and probable requirements in specifications pertaining to type and details of distributors and the work to be done; (3) different types and grades of bituminous materials which the machine will distribute, and the range in the amount per square yard which can be applied; (4) the range in pressure per square inch; (5) method of controlling uniformity and amount of distribution; (6) accessories of distributors for heating material, recording temperature of bituminous material, amount in tank, amount of pressure, and shutting off bituminous material at end of run; (7) width of distribution and means for modifying same; (8) motive power; (9) width of tires and loads per linear inch of tires when tank is full; (10) ease of operation and repair; (11) structural strength; (12) amount and character of labor required to efficiently operate the distributor; (13) economics, including overhead, operation and maintenance charges.

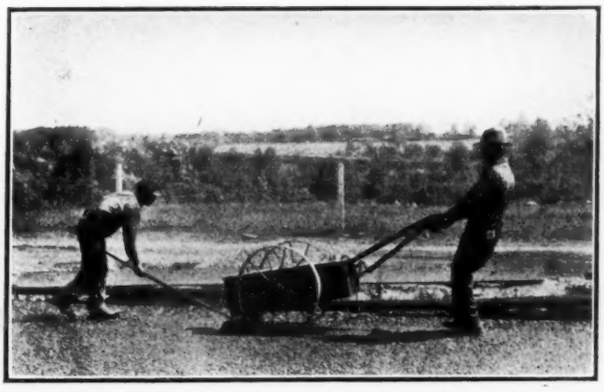

FIG. 10—APPLICATION OF SEAL COAT BY HAND-DRAWN DISTRIBUTOR ON CLASS A BITUMINOUS CONCRETE.

BITUMINOUS CONCRETE PAVEMENTS.

As defined by the Special Committee on "Materials for Road Construction" of the American Society of Civil

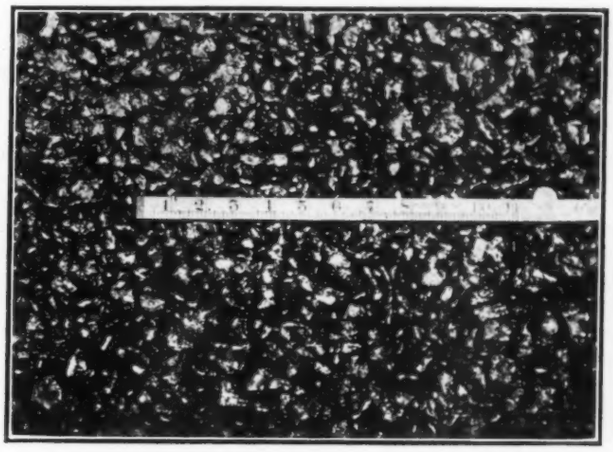

FIG. 9—SURFACE OF BITUMINOUS CONCRETE, CLASS A, BEFORE APPLICATION OF SEAL COAT.

Engineer, "a bituminous concrete is one composed of broken stone, broken slag, gravel or shell, with or without sand, Portland cement, fine inert material or combinations thereof, and a bituminous cement, incorporated together by a mixing method."

Bituminous concrete pavements may generally be grouped into three classes, having the following characteristics:

Class A. A bituminous concrete pavement having a mineral aggregate composed of one product of a crushing or screening plant.

Class B. A bituminous concrete pavement having a mineral aggregate composed of a certain number of parts by weight or volume of one product of a crushing or screening plant, and a certain number of parts by weight or volume of sand, broken stone screenings or similar material, with or without a filler.

Class C. A bituminous concrete pavement having a predetermined mechanically graded aggregate composed of broken stone, broken slag, gravel or shell, with or without sand, Portland cement, fine inert material or combinations thereof.

This discussion will be confined to pavements of

FIG. 11—CONSTRUCTION OF TOPEKA BITUMINOUS CONCRETE PAVEMENT.

Classes A and C. The status of bituminous concrete pavements of Class B is covered by the following conclusion presented by the Committee of the American Society of Civil Engineers mentioned above:

"Specifications for pavements of this class have generally stipulated that so many parts of broken stone or gravel and so many parts of sand or other fine material are to be mixed with a certain quantity of bituminous cement. By the use of this specification, and with unusual supervision, it is practicable to secure a fairly well-graded aggregate; but in most cases the mixture will be found to contain an excess of broken stone, with insufficient fine material to fill the voids therein, and in other cases it will contain an excess of sand in which the broken stone is held as isolated particles."

Foundations. The foundation should be strong enough to carry the traffic to which the pavement is to be subjected. Many failures have occurred due to laying bituminous concrete pavements on weak foundations. Satisfactory results have been obtained under medium traffic with thoroughly filled and compacted broken stone, and bituminous concrete foundations. Cement-concrete foundations have been used successfully under the heaviest traffic for which the several classes of bituminous concrete are suitable, especially in cases where the road-beds have been well drained.

Bituminous Materials. The bituminous cements which have been used successfully in the construction of bituminous concrete pavements of Class A include asphalt, water-gas tar and coal-tar cements, and cements which are combinations of refined tars, and combinations of refined tars and asphalts. Experience has demonstrated that the most efficacious bituminous concrete pavements of this class are constructed by using suitable asphalt cements or refined tars in the mix, and asphalt cements for seal coats. Satisfactory results will be secured when tar cements are used for seal coats, but the surface must be re-treated more frequently than when asphalt cements are used. For Class C pavements, asphalt cements are used almost exclusively, tar cement having been employed to a limited extent.

The amount of bituminous cement used is generally expressed as the per cent, by weight, of bitumen in the bituminous concrete, not including the bituminous cement used as a seal coat. For Class A, the per cent of bitumen varies from 5 to 8 per cent, and for Class C, from 7 to 9 per cent. French engineers should note that the above use of the word bitumen is based upon the American definition which states that bitumen is that portion of an asphalt or tar cement which is soluble in carbon disulphide.

Class A. A large mileage of bituminous concrete pavements of this type have been constructed in the United States, the aggregate of which complies with the following specification adopted by the American Society for Municipal Improvements: "Broken stone for the mineral aggregate of the wearing course shall consist of one product of a stone crushing and screening plant. It shall conform to the following mechanical analysis, using laboratory screens having circular openings: All of the broken stone shall pass a 1¼-inch screen; not more than 10 per cent nor less than 1 per cent shall be retained upon a 1-inch screen; not more than 10 per cent nor less than 3 per cent shall pass a ¼-inch screen."

Plants of many types (see Figs. 4, 5, 6 and 7) have been successfully employed in the manufacture of Class A bituminous concretes. Naturally the most economical and efficient work has been accomplished by plants especially adapted for mixing Class A aggregates. Generally, on highway work outside of urban districts, the portable plant proves most satisfactory. Dependent upon the plant accessories, the aggregate is measured by

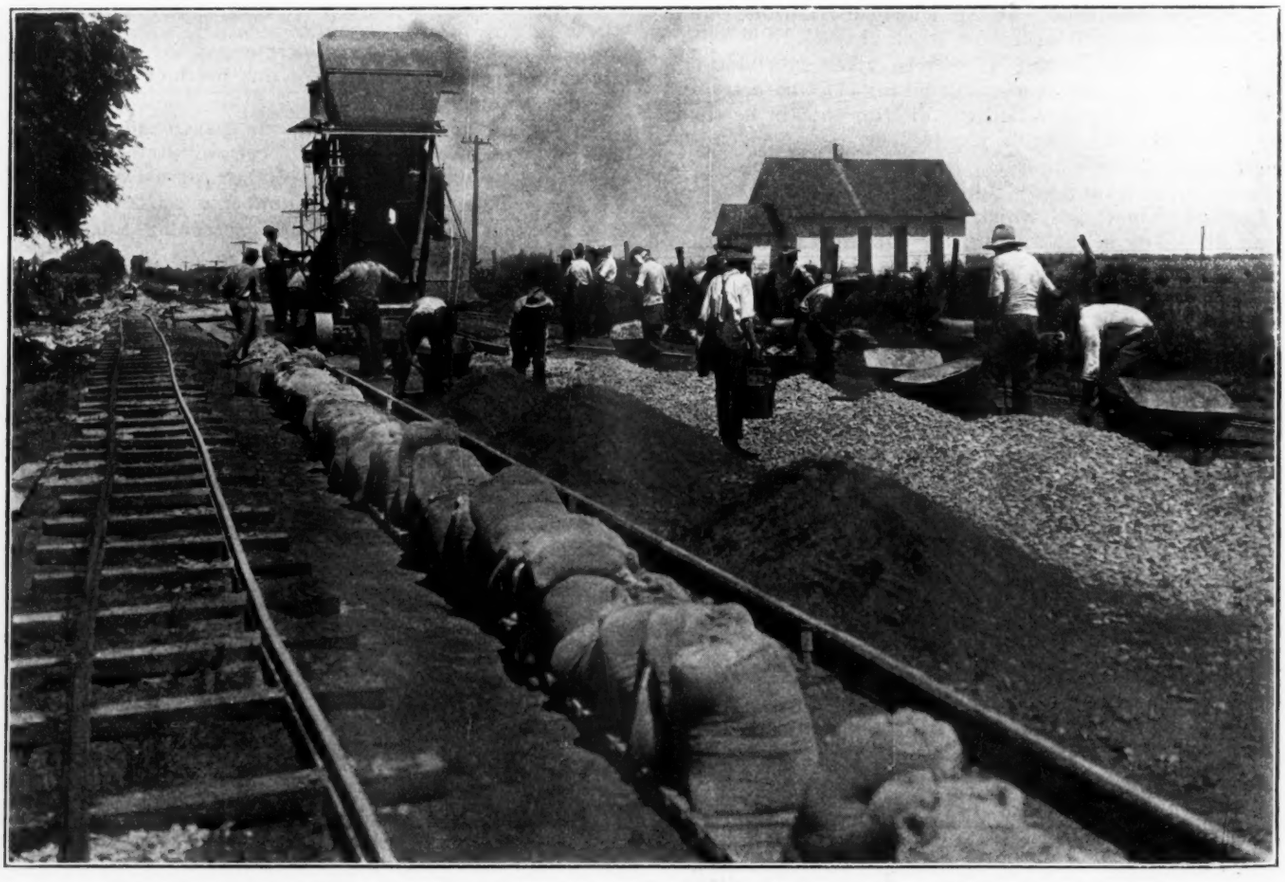

FIG. 12—MIXING GANG AND MATERIALS FOR CONSTRUCTION OF CEMENT CONCRETE PAVEMENT.

volume or weight before being dried or by weight after drying, the latter being preferable. The aggregate is usually dumped into bucket elevators, which discharge into rotary driers. In the best types of plants, the heated aggregate is then raised by bucket elevators and discharged into a small storage bin. As desired, the heated aggregate is drawn from the storage bin and allowed to fall directly into the pug mill mixer or, preferably, first into a weighing box. The bituminous cement is weighed in scales on the mixing platform and then dumped into the mixer. After thorough mixing, the bituminous concrete is usually discharged into a wagon or truck, which the plant arrangement permits to be placed directly beneath the mixer.

In cases where neither curbs, gutters nor edgings are used, thoroughly compacted shoulders are constructed. To serve as definite boundaries and to prevent the bituminous concrete from being forced out over the shoulders during rolling, 2-inch planks may be placed on the shoulders at the edges of the roadway and allowed to remain until after the seal coat is applied. After the bituminous concrete has been deposited on the foundation course, it should be uniformly spread by raking (see Fig. 8) to a depth such that when compacted the wearing course will have the desired thickness, which is usually 2 inches (see Fig. 9). After being uniformly distributed, the bituminous concrete is rolled while it is still warm and pliable. The rolling should begin at the edges and work towards the center. Rolling should continue without interruption until all roller marks disappear and the surface shows no further compressibility. Any places which the roller cannot effectively compress should be compacted with hot iron tampers. Excellent results can be secured by the use of tandem rollers, weighing between 8 and 12 tons and having a compression under the rear roller of from 250 to 350 pounds per linear inch of roll. Equally good results have been obtained by using a 5 to 8-ton tandem roller to shape up the wearing course, and a 12-ton three-wheeled roller for the thorough compaction of the bituminous concrete. In order to prevent ashes from dropping onto the bituminous concrete, each roller should be provided with an ash pan.

After the wearing course has been rolled sufficiently so that the wheels of the roller do not make any creases, a coat of bituminous cement is applied to the surface. The surface should be clean and absolutely dry when the seal coat is applied. In many cases the bituminous concrete will have to be thoroughly swept before the application of the seal coat. From ½ to 1 gallon per square yard of bituminous cement should be used, the requisite amount varying directly with the openness of the compacted bituminous concrete surface and the kind of bituminous cement used. The best method of constructing a uniformly distributed seal coat is to use a hand-drawn gravity distributor followed by a man pushing a rubber or leather squeegee (see Fig. 10). The squeegee should have a width greater by from 4 to 6 inches than the width of the sheet of bituminous cement as it falls from the distributor. By being kept from 2 to 4 inches back of the sheet of bituminous cement, a very even distribution may be easily obtained. As soon after the application of the bituminous cement as possible, a thin layer of dry, clean chips should be uniformly spread over the coat of bituminous cement, the total amount of chips being preferably distributed in two applications. The chips should be rolled at least twice in order to force them into the interstices of the surface and secure the maximum bond with the bituminous cement.

Class C. The two types of bituminous concrete pavements of this class which have been used most extensively in the United States are known as Topeka (see Fig. 11) and Bitulithic pavements.

The characteristics of the Topeka pavement are covered by the following specification for its aggregate as adopted by the American Society for Municipal Improvements:

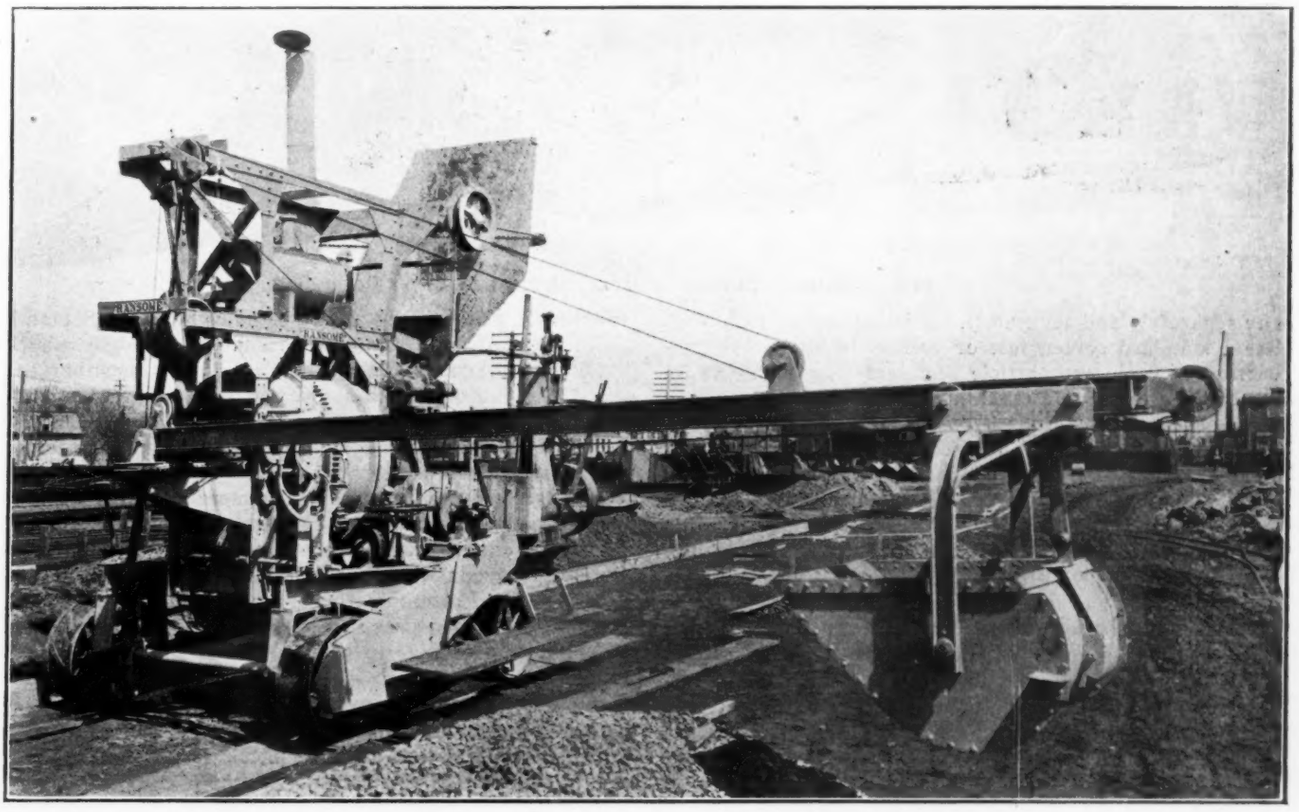

FIG. 13—RANSOME MIXER: BATCH TYPE WITH BOOM AND BUCKET.
Capacity—10 cu. ft. of wet mixed concrete, or 14 cu. ft. of loose aggregates.

"The proportions of the various ingredients composing the bituminous concrete shall be as follows:

Bitumen	7 to 9%
Passing 200-mesh sieve	7 to 10%
Passing 80-mesh sieve, but retained on a 200	10 to 20%
Passing 40-mesh sieve, but retained on an 80	10 to 25%
Passing 20-mesh sieve, but retained on a 40	10 to 25%
Passing 8-mesh sieve, but retained on a 20	10 to 20%
Passing 4-mesh sieve, but retained on an 8	15 to 20%
Passing 2-mesh sieve, but retained on a 4	5 to 10%

The Bitulithic pavement is patented in the United States. The method of its manufacture is as follows, as described by a representative of the patentees: "The operation of a semi-portable Bitulithic plant is as follows: The raw materials, namely, crushed stone, screenings, and sand, are fed from the storage piles at the rear of the plant into the cold-stone elevators, are heated in the driers, then elevated to the rotary screen, which is enclosed in a screen house. This screen consists of the several sections which are required to separate the mineral aggregate into the various sizes. The hot stone passing each of these screen sections drops into its compartment in a sectional bin and is thus kept separate from other sizes. The boxman weighs out the amount of each size required into a weigh-box supported on platform scales with a multiple beam which enables him to weigh each size separately and accurately. It is impossible to formulate a standard screen test or rule as to just what proportion of each size particle of mineral aggregate is required to produce the maximum density or minimum of voids, because the stone from different quarries crush into different shapes. The proportions are scientifically determined for each case by laboratory tests. By following the best practice as described, the resulting combination of varying sizes of mineral aggregate will contain approximately 12 per cent of voids to be filled with bituminous cement. While the weighing is taking place, the mixer-man has filled the bituminous cement bucket with the required weight of Bitulithic cement by dipping from the melting tanks, the weight of bituminous cement being accurately measured by scales on the bucket carrier. The bituminous cement and mineral aggregate are then emptied into the mixer and thoroughly mixed until all particles are completely coated and the mass has been transformed into a uniform bituminous concrete, when the slide under the mixer is opened and the batch dropped into the wagon waiting under the platform."

The methods of laying, rolling and finishing bituminous concrete pavements of Class C are similar to the methods previously described with reference to Class A pavements, except that many Topeka pavements are not finished with a seal coat of bituminous cement.

CEMENT-CONCRETE PAVEMENTS.

In the United States, the first cement-concrete pavement, that is one having a wearing course of hydraulic cement concrete, was laid in the State of Ohio in 1894. It was not until 1900, however, that this material was used to any extent as a wearing course. The utilization of cement-concrete as foundations is of long standing in the United States. Its record as an efficient foundation, especially when laid on a well-drained roadbed, is well known to French engineers. The cement-concrete pavement is as yet in its infancy as compared with roadways of broken stone, stone block and some others. In considering its use on the highways of France, therefore, its dual capacity should be kept in mind. On roadways destroyed or badly worn it may be an economical proposition to use cement-concrete pavements constructed at such elevations that after their period of life as pavements has expired they may serve efficiently as foundations for new wearing courses.

Subgrade and Foundation. Cement-concrete pavements should be laid only on a well-compacted and well-drained subgrade. The surface should usually be made flat and should be thoroughly rolled with a medium-weight roller. Prior to the deposition of the concrete the subgrade should be thoroughly wet, otherwise the subgrade will absorb water from the concrete, thus preventing a uniform set and decreasing its strength.

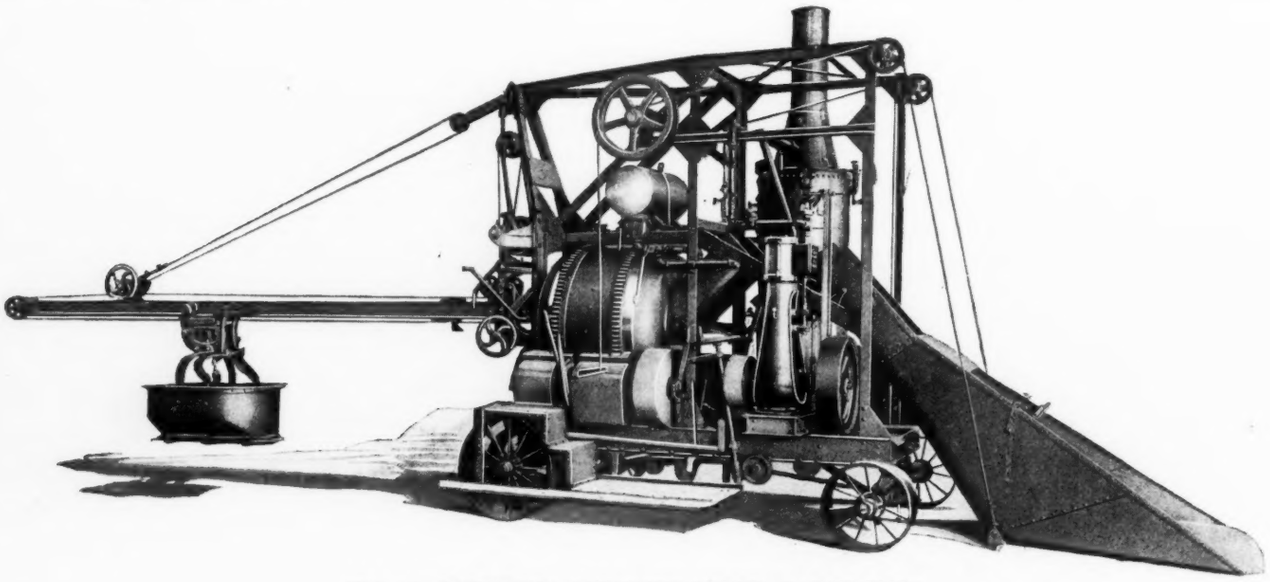

FIG. 14—KOEHRING CONCRETE MIXER, BATCH TYPE.

Ingredients and Proportioning. The materials used for the fine aggregate of a cement-concrete pavement are generally sand or stone screenings, and for the coarse aggregate either broken stone or gravel. The broken stone employed should be obtained by crushing hard, tough rock. Preferably the stone should be composed of naturally graded sizes and free from dust or dirt. What has been said relative to broken stone applies as well to gravel, since a screened gravel with the fine material eliminated allows a more accurate determination of the correct proportions. The sand used should be clean, sharp, and coarse, free from loam, clay, and vegetable or organic matter. The cement should be a first-class Portland cement that will meet the standard specifications of the American Society for Testing Materials. Care should

be taken to use clean water, since water which contains any alkalies or acids will be detrimental to the concrete. The proportions which are used in connection with the construction of concrete foundations are not rich enough in either cement or mortar to make satisfactory concrete which is to be subjected to the abrasive and impact forces of traffic. The proportions used for the best class of cement-concrete pavements are about one cement, one and one-half or two fine aggregate, and three coarse aggregate.

The following excerpts from conclusions reported in 1918 by the above mentioned committee of the American Society of Civil Engineers are worthy of note: "Fine aggregate may be sand or screenings from hard, durable rock that will pass a screen having ¼-inch circular openings. The best fine aggregate is in general that which is graded fairly uniformly from the ¼-inch size mentioned above, downward, but not more than five per cent should be of such fineness that it will pass a sieve having 100 meshes per linear inch. Coarse aggregate in general should not be larger than will pass a screen with 2-inch circular openings, ranging down fairly uniformly from this size to that retained on a ¼-inch screen. A denser and more uniform concrete may be made by screening the material, both fine and coarse aggregates, into different sizes and re-combining these different sizes in such a way as will give the densest mixture, that is, the smallest percentage of voids, when dry (than by following the arbitrary rule of a 1:2:3 mix, for example). The slight increase in time and expense which is incurred by determining the voids and combining the various sizes to get the greatest density is more than repaid by the strength and density of the resulting mixture. Similar care in the determination of the proper quantity of water is also to be desired in order that the concrete may have a uniform consistency as it is deposited in place. Though the mixture should be rather wet, especially if it is deposited without tamping, it should still be stiff enough to hold its shape when struck off by the template, and yet not result in segregation of the different sizes throughout the mass."

Construction. The essential features of a plant operation are covered by the following excerpts from a report of a committee of the National Conference on Concrete Road Building: "The concrete mixer should be of the batch type provided with an automatic water tank, traction drive and power loader. Mixers having a boom and bottom-dump bucket (see Figs. 13 and 14) of sufficient size to convey one complete batch for placing the mixed concrete are preferred. Where necessary to keep from cutting into the subgrade and to facilitate moving, the wheels of the mixer should be run on suitable planking. The mixer should be provided with a suitable automatic water tank which can be quickly filled and emptied, so that when once determined, the required amount of water can be added to each batch of concrete. The power loader or skip should be of sufficient size to hold all the materials required for the batch. In charging the skip a part or all of the coarse aggregate should be placed first, and the cement, fine aggregate, and remaining coarse aggregate, if any, on top of this. All the cement should be in the skip before the last of the aggregate is added. The filling of the skip is accomplished in practice in two ways; by the use of wheelbarrows (see Fig. 12) and by shoveling direct from the supply piles into the skip. This latter practice, however, should be discouraged, for accuracy is impossible, and it encourages carelessness. Besides, the entire loading gang loses time waiting, while the skip is raised and lowered. It is recommended that all the materials in any one batch, including the water, should remain in the drum of the mixer at least 45 seconds before any of the concrete is discharged."

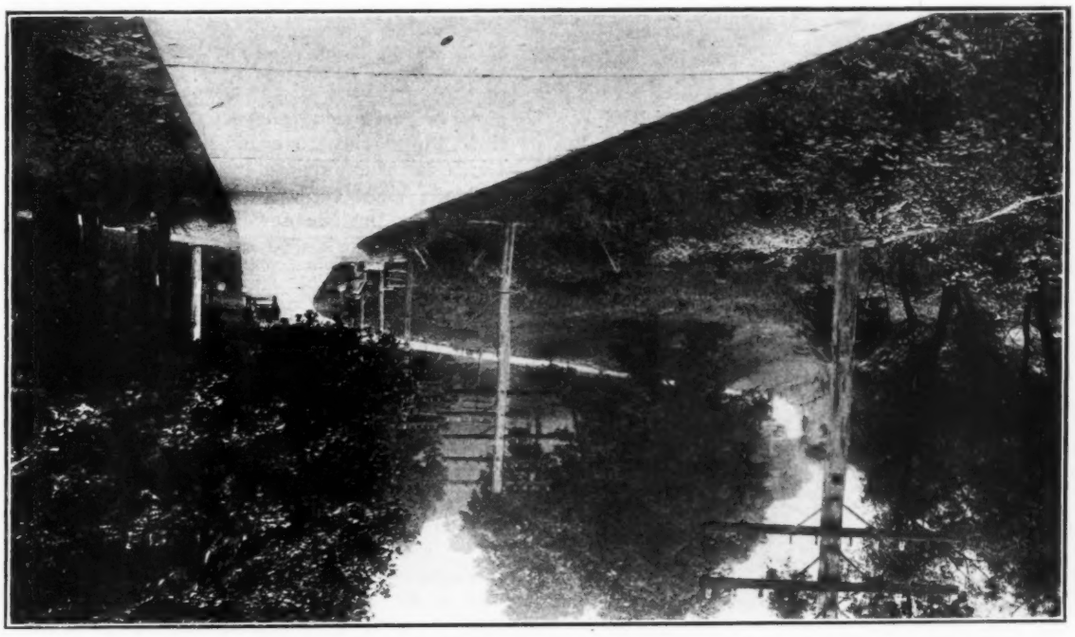

FIG. 16—FINISHED CEMENT CONCRETE PAVE MENT, SHOWING TRANSVERSE EXPANSION-CONTRACTION JOINTS.

In plain cement-concrete pavements constructed by the mixing method, generally the concrete is deposited in one layer. Usually the average transverse slope does not exceed ¼ inch per foot. The thickness varies from 5 to 10 inches, dependent on traffic requirements and other local conditions. More attention should be paid to obtaining a smooth and regular surface in constructing cement-concrete pavements than is usually accorded concrete foundations. The use of templates to strike the surface of the concrete, and of bridges (see Fig. 15), which span

the concrete surface, thus enabling the laborers to work over the surface without standing on it, should be insisted upon. The surface may be finished by the use of wood floats (see Fig. 15), belts or light hand rollers. It is also important to protect the surface from too rapid drying out while the concrete is curing, otherwise shrinkage cracks are liable to occur. This is accomplished sometimes by covering the pavement as soon as it has taken its initial set with a canvas which is kept moist for a few hours. The canvas is then removed and the surface is covered with a layer of sand or earth, which is kept thoroughly moist for a period of two weeks.

Expansion Joints. Transverse joints (see Fig. 16) always should be provided. There will be more or less contraction and expansion of the concrete due to changes of temperature, variation in the moisture content of concrete, and variation in the condition and character of the subgrade. If expansion joints are not present, when the concrete contracts, the tensile strength of the concrete will be exceeded and the pavement will crack; when it expands it will tend to crush, spall, or bulge. The edges of the joints must be protected from the abrasive action of the traffic, and it is obvious that the joints should be filled with a material that will allow some movement between the joints as the pavement expands and contracts. The width of the transverse joints depends upon the distance between them. It is considered better practice to construct narrow joints at short intervals apart rather than wide ones far apart. Transverse joints are placed from 15 to 50 feet apart, 30 feet being an average distance.

If curbs are used, longitudinal joints should be constructed adjacent thereto. The width of the longitudinal joints will depend somewhat upon the width of the pavement. They are usually made from ½ to 1½ inches wide and are filled with a bituminous filler or a patented expansion joint is employed.

Reinforced Pavements. Reinforced cement-concrete pavements are usually constructed by the two-course method. The reinforcement usually consists of woven wire or expanded metal, although a mesh work of small round bars is sometimes used, and generally is placed between the base and the wearing course. At the last National Conference on Concrete Road Building, held in 1916, a committee reported that "it is only recently that reinforcement has been used to any great extent, and the interval is too short for the accumulation of the data necessary to standardize practice."

Miscellaneous Machinery. The limitations of this article do not permit a detailed discussion of the practicability of using, in connection with the reconstruction of French highways, many types of road machinery which have been found efficient in the United States. Graders, ditching machinery, portable steam shovels, special types of motor trucks and trailers, industrial railways, and loading devices may be mentioned as American machines which would well repay investigation if it was deemed advisable to send a commission of French highway engineers to the United States to study American methods and machinery used in highway improvement.

BILLINGS WATER WORKS NOTES.

The Billings, Montana, Water Department had 210 fire hydrants on its distribution system at the time of the 1918 report of the superintendent, J. F. Willett, and the city council had authorized the purchase of 40 sprinkling cart cranes; "which," says Mr. Willett, "is a wise thing to do, as fire hydrants are set for fire purposes only and should not be used as filling stations."

Heretofore, during the summer months the hydrants have been used by the street department for flushing streets and sewers and by the street sprinklers, and the superintendent in several previous reports has recommended this action. We agree with him that it is a wise move for the city; and it is unfortunate, in our opinion, that more cities do not set more of these appliances for preventing improper use and possible damage of fire hydrants.

Another action announced in this report is a decision of the Board of Water Commissioners to meter all services. On July 1, 1918, there were 723 meters in use, but a year later the number had been increased to 2,427, or about 75 per cent of the total number of services.

Superintendent Willett recommends using existing earth settling basins during such times as the river is most turbid, to secure sedimentation of the suspended matter before the coagulants are applied. He estimates that this would permit saving $2,000 a year in coagulants. The cost of putting the reservoirs into service would be between $4,000 and $5,000.

SURVEY OF BALTIMORE'S BOUNDARY.

The Legislature of Maryland on March 29, 1918, passed an act providing for annexing additional areas to the city of Baltimore, and this act gave power and authority to the surveyors of the Topographical Survey Commission, in performing the necessary work of laying out the new boundaries, to enter upon private properties at all times for the purpose of making surveys, and gave the city the right to erect and maintain suitable stones or posts marking the new boundaries.

The commission shortly after began making the preliminary surveys for establishing the new boundary lines, and these surveys have now been completed, and the line is marked by stakes where it crosses roadsides and at other points. As the survey was not completed until winter was practically at hand, no effort is being made to place any concrete or stone monuments along the boundary, but the commission expects to do this next spring.

The preliminary work began about June 1 and consisted of the extension into the newly added territory of the triangulation system which was established some years ago when a precise survey was made of the city. Twenty-seven new triangulation stations were established, but it was necessary to erect only one tower, the other stations being established on existing buildings and points on the ground. The tower that was erected was about eighty feet high and was constructed of timber.

Traverse lines were run between the triangulation stations, and during the present year it is expected to tie in these lines with the old traverse lines of the previous survey. In running these traverse lines the field work was performed with the greatest care, each angle being read six times, and the lines were measured with carefully tested steel tapes, the temperature of which was noted during the surveys and corrections made for expansion and contraction. The field force was composed of one triangulation party and four traverse parties, and an office force of computers brought the total number of men up to twenty-five.

As soon as all monuments have been permanently set, three plats will be prepared and duly certified by the chief engineer of the Topographical Survey, Major Joseph W. Shirley, the surveyor of Baltimore county, and the surveyor of Anne Arundel county. These plats will be recorded, one in the office of the clerk of the Circuit Court of each of these counties, and the third in the office of the clerk of the Superior Court of Baltimore.

Municipal Journal

Published weekly at
243 West 39th Street
by
Municipal Journal and Engineer, Inc.

S. W. HUME, President
J. T. MORRIS, Treas. and Mgr. A. PRESCOTT FOLWELL, Sec'y

A. PRESCOTT FOLWELL, Editor
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Telephone, 9591 Bryant, New York
Western Office, Monadnock Block, Chicago

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Contributions suitable for this paper, either in the form of special articles or as letters discussing municipal matters, are invited and paid for.

City officials and civic organizations are particularly requested to send to Municipal Journal regularly their annual and special reports.

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THE STREETS OF WASHINGTON, D. C.

Up to two years ago, Washington was the capital of the country, in that it was the seat of the Federal Government, but in no other way. It was not a center of business, and what few organizations of a civic or commercial nature had established their headquarters there did so because the secretary was a Federal official rather than from any policy. When we entered the war, however, all other business became secondary to that of providing munitions, hundreds of heads of "big business" located there, and all lines of business and industry, of professional, industrial and labor organizations, and of most other branches of human activities, had representatives there. Washington took on many of the characteristics of a "boom" town.

Will the capital relapse to its former condition? There are many indications that it will not, but that national organizations, professional, social and industrial, as well as patriotic, will adopt that city as their headquarters, and that the large affairs of the country will be conducted there. If this be so, will the city continue to display the outward aspect of a country village? Will its pavements and sidewalks show long-neglected need of repairs? (For years the streets and walks around the capitol itself were in a disgraceful state of unrepair.) Will its street cleaning be performed intermittently and carelessly? Will disreputable shacks and unsightly slums continue to thrust themselves within a block or two of the congressional and departmental buildings?

Not one or two but scores of city engineers and other municipal officials have stated to the writer during the past ten years that these conditions in Washington seemed to them a disgrace to the country. To this city more than to any other (unless perhaps New York) come visitors from all over the Union. The opportunity is therefore unique for furnishing to the entire country an object lesson of what a city should be, but there is no indication that any effort is being made to this end. Elaborate plans have been prepared for the expenditure of millions in the construction of an architectural picture—a Federal center which might inspire the creation of civic centers throughout the country. But there is no inspiration to civic cleanliness, neatness, and orderliness. No visitor is given ocular demonstration of the possibilty of making residence and even business streets places in which it is a pleasure to walk; no public works official finds here details of street construction, street appurtenances, and street administration that impress him as worthy of adoption by his own city.

Washington is the city of the United States. It can draw upon untold billions of dollars for its administration. We are proud of the capitol, of the Congressional library and other Federal buildings; but as a city we are ashamed of it. It is to be hoped that, should it become a center of business, as well as of legislation, it will no longer be permitted to suggest a combination of silk hat and diamond scarf pin with muddy, down-at-the-heel shoes and shapeless, frayed trousers.

MUNICIPAL BONDS.

The most interesting facts about municipal bond sales during 1918 are the amount marketed and the prices at which they were sold. According to "The Bond Buyer," states and municipalities issued $260,661,464, which is about sixty per cent. of the amount issued in 1917 and fifty-three per cent of the 1916 total. When it is considered that during practically the entire year the Capital Issues Committee was exercising strict control over the issuing of bonds, and that the scarcity and high cost of labor and materials discouraged any but the most necessary construction, this total is larger than might have been expected.

Of more present interest as an indication of what may be expected this year are the prices obtained. In spite of the fact that billions of dollars worth of Liberty Bonds were sold and for a considerable part of the time monopolized attention, the change in price during the year was favorable to "municipals." The net income basis on which bonds of a number of large cities were sold dropped from an average of 4.66 per cent during the first four months to an average of 4.52 per cent during the last four, the first few days of 1919 showing sales on a 4.44 per cent basis. The average for the four years previous to 1918 was 4.16 per cent. Considering that the bill now in conference committee of Congress triples the income tax rate, and that interest on municipals is exempt from such tax, there seems to be every reason for supposing that the price at which cities can market bonds this year will be even more favorable than last year—as advantageous, in fact, as during 1913, 1914 or 1915 (4.16 per cent to 4.45 per cent).

EXPERT SUPERVISION OF WATER PURIFICATION.

Reference is made on another page of this issue to a typhoid epidemic which was suffered by Xenia, Ohio, because there was no one connected with the plant able to detect that the hypochlorite used was far below guaranteed strength. It would be interesting to learn how many water purification plants there are in the country where similar absence of expert supervision may at any time lead to an experience similar to Xenia's. That the number of such plants is very considerable seems unfortunately certain. In Ohio there are 48 water filtration plants and 12 disinfection plants, and of the former 16 have no expert technical supervision, while of the 12 disinfection plants, 4 are without such supervision. The Ohio State Board of Health is one of the most efficient in the country, and Ohio cities are among the most progressive, and it is therefore probable that in many other states the percentage of plants receiving expert supervision would be less than in Ohio. As the State Board

of Health says: "Operation of a purification plant by a man without technical training, however faithful and conscientious he may be, is always dangerous. A trained man can detect at once, by examination of the water, whether purification is being properly carried out. Where an untrained man is in charge, imperfect purification is more likely to be detected after the damage has been done."

THE FIRST ANNUAL REPORT.

A year ago we advised our readers that we had received prior to January 17 two annual reports for the year ending December 31, both typewritten but complete and of some length. The second to be received was that of T. Keith Legare, city engineer of Columbia, S. C. This year Mr. Legare has moved to first place, his report of eight pages exclusive of tables having been received on January 6. One paragraph of the report reads: "This report has been compiled at the earliest possible date in order that it may be of some service to the council in preparing their budget and plans for the coming year's work."

BOULDER'S BUDGET.

The first comparative budget of Boulder, Colo., prepared in compliance with the city's new charter by city manager E. O. Heinrich, has as its prominent characteristics completeness combined with conciseness and simplicity. Any citizen of average intelligence should be able to learn from it how it is proposed to spend next year's taxes, whether more or less is to be allotted to each class of services than during the two previous years, and why. The budget is prepared and made public three months before the end of the year, and a public hearing on it is given before its adoption by the council.

First is given the revenues from all sources during 1917 and 1918 and those estimated for 1919, itemized by sources. Next, the program for the municipal water plant for the year 1919. Then, departmental allotments, giving totals for each department and division. Following this, a more complete itemizing of each allotment, a table for each department. A statement is given of the interest-bearing liabilities of the city; the per capita expenses during 1917 and 1918 and required for 1919; and finally the sinking fund requirements. Together with three pages of comment and explanation, the whole occupies 20 not-too-crowded pages.

This year's budget indicates careful scrutiny of each item of the allotments requested by the several departments, there being no proportional cutting all down the line. Some items were decreased, a few increased, and ten were cut out altogether.

PUBLIC WORKS PHOTOGRAPHY.

In his annual report for the year 1917-1918, the city engineer of Salt Lake City, Sylvester Q. Cannon, makes the following references to changes in the engineering department's practice in the taking of photographs and blueprinting:

Owing to the increased cost of photographic plates it was deemed advisable, early in the year, to discontinue the making of sewer plat copies by this method, until the latter part of the year there were no copies made. It was then decided to try making the copies direct on photostat paper, which eliminates the negatives and reduces the cost to about five cents each, which is less than twenty-five per cent of the plate method.

The substitution of films for plates on account of their superior photographic merits, also their adaptability for filing and handling without breakage, was another change made by this division.

The following is a summary of the work done during the year:

Negatives made: 88, 8 inches by 10 inches; 98, 6½ by 8½ inches. Prints: 512, 8 inches by 10 inches; 120, 6½ inches by 8½ inches. Of the above 105 prints were made for the Street Department, 36 prints were made for the Law Department, 15 prints were made for the Water Department, 12 prints were made for the county surveyor. The cost per print during the year was $.63.

During the year 8,400 square feet of paper blue-prints were made at a cost of $.051 per square feet, 945.0 square feet of cloth prints at cost of $.135 per square foot, and 315.0 square feet of Van Dyke prints at $.097 per square foot.

XENIA'S TYPHOID EPIDEMIC.

There was an outbreak of typhoid fever in Xenia, Ohio, during the latter part of August and the first half of September, 1918, in which there were forty-four cases. The matter was investigated by the State Department of Health, which attributed the epidemic to defective hypochlorite used as a disinfectant.

All the epidemiological evidence pointed to the water supply as the source of infection, the cases being widely distributed, engaged in various occupations, none had eaten raw shell-fish nor attended public gatherings for some time prior to falling ill, and neither milk, ice cream nor fresh vegetables could be connected with the epidemic.

The city's water supply is obtained part from drilled wells and part from surface water. As the latter had been shown several times to be unsatisfactory, a hypochlorite disinfection plant was installed in 1914, about one-third of the city's consumption coming from this disinfected surface supply. The investigators found that the bleaching powder had been added in the definite prescribed quantities for more than two years, but on analyzing the bleaching powder it was found to be of only one-fifth the guaranteed strength. Quoting from the report: "Since this substance was guaranteed to be of proper strength, it follows that the undertreatment of the city's water was purely accidental; nevertheless, it is significant that such a possibility always exists when disinfection of the public water supply is necessary to render it safe for domestic use. In order to avoid the recurrence of a polluted water being supplied the consumers at Xenia, the water company should abandon the existing supply at the Springfield Pike station (the surface and ground water source) and procure water of satisfactory sanitary quality from another source. In the meanwhile, it is advisable that the company abandon its hypochlorite method of disinfection and employ the more dependable and up-to-date method using liquid chlorine."

Commenting on this report, the editor of the Ohio Public Health Journal expresses the opinion that two lessons are to be learned from this experience, one that no community should depend for its water supply upon disinfection only of an unsafe water, the second being that no purification plant can be operated safely without expert supervision. The human factor being all-important in disinfection by hypochlorite, the treatment renders water safe only when the chemicals are of good quality and the operator performs his duties unerringly. In this case, the superintendent was faithful in performing his duties in connection with adding the bleaching powder, but having no chemical training, did not detect that it was below normal strength. Bleaching powder should be abandoned in favor of liquid chlorine, which is not subject to deterioration such as occurred in Xenia, and the plant should be supervised by a technically trained expert, able to keep a careful check upon the quality of the disinfected water.

The WEEK'S NEWS

United States Starts Billion Dollar Road Building Campaign—Influenza Causes Death Rate Increase Throughout Country—Big California Power Systems Interconnect—Ohio Firemen Install Eight-Hour Day Themselves—Firemen's Pensions in New Jersey to Be Systematized—$34,000,000 Reconstruction Plans of St. Louis—State Commission Has Power to Raise Fares in Missouri—Federal Cooperation in Port Development—Government Housing Situation.

ROADS AND PAVEMENTS

Government Sponsors Great Building Boom.

Washington, D. C.—Highways, other public works, public utilities and houses are the object of a big campaign of building started by the government in order to help tide over the period of demobilization and reconstruction. Definite and practical steps have already been taken. An organization to conduct the campaign is now being created, with headquarters at 16 Jackson place, Washington, under the general supervision of Secretary Wilson of the Department of Labor, and with the cooperation of the American Federation of Labor and other labor interests. The following slogan has been adopted: "Build now for greater and better America. A billion for roads; two billions for public works; three billions for a million new American homes. What are you doing to help this campaign?" The Department of Labor, as one of the first steps in the campaign, is sending the following message to wage earners throughout the country: "Use your influence with your city fathers, your selectmen and other town officers to start at once municipal and town improvement." Cities and towns are being urged to build school houses, engine houses, roads, canals and other improvements. To those who believe that the cost of building will be less in a few years than it is now, the Department of Labor is replying that "probably 95 per cent of the cost of a residence ultimately goes to labor whenever a house is built, so that the cost is almost immaterial to wage earners as a class." Secretary Baker of the War Department is cooperating in the campaign, and has sent telegrams to the governors asking them to urge in inaugural messages the immediate resumption of building of every character. One of the first branches of the new activity of the government to be organized is the "Own a Home" branch, which has been placed under the direction of the Information and Education Service of the Department of Labor, of which Roger W. Babson is chief. Mr. Babson is creating an organization of assistants, headed by Franklin T. Miller, of New York City.

Congress Turns to Highway Legislation.

Washington, D. C.—Six bills dealing with highway construction were introduced in Congress in the last month. Senator Smoot has introduced a bill which provides for a complete reorganization of highway administration by the Federal Government while other bills would use present agencies. These are either amendments to the present Federal-aid highway law or utilize the organizations of the War and Post-office Departments. A joint resolution has also been introduced, which provides for the handing over to the Secretary of Agriculture by the Secretary of War of such war material as may be used in highway construction work. Senator Smoot's bill provides for the formation of a United States Highway Commission, to be composed of the chairman of the Senate Committee on Postoffices and Post Roads, the chairman of the House Committee on Roads and the Director of the Bureau of Public Roads. It proposes to issue bonds to the amount of $1,000,000,000, the proceeds of which will be distributed to the states in proportion to the average percentage of their percentages of population, total assessed valuation, and total mileage of public highways. When money is supplied to the states, they must deposit state bonds, drawing interest at 4 per cent, to cover the amount advanced to them. The 4 per cent interest shall pay the 3 per cent rate on the United States highway bond issues, and also establish a sinking fund to pay for these bonds. Long-time payments are provided for the state bonds. It is further provided that the Federal Government shall pay yearly to the depositing states 2 per cent of the amount deposited to be expended in maintenance. Of the four bills providing for the utilization of the present federal highway administration, those by Senator Bankhead and Senator Swanson, in the Senate, and Representative Browne in the House of Representatives, are practically identical. They are in the form of amendments to the present Federal-aid highway law and consist of a change in wording to permit a wider interpretation of the words "post road," to cover any road that might so be used. They also provide for the appropriation of $50,000,000, to be immediately available; $75,000,000, available July 1, 1919; $75,000,000, available July 4, 1920; and $100,000,000, annually to July 1, 1924. Another bill, introduced by Representative Shackleford, provides for a similar change in wording and for an appropriation not to exceed $150,000,000 per year. The other bill was introduced by Senator Swanson, and provides for the setting aside of 50 per cent of the net proceeds derived from the operation of motor trucks engaged in carrying parcel post, to be expended in the survey, construction, reconstruction, improvement, repair, maintenance and administration of such highways as might be selected by the Postmaster General for the transportation of mail.

Memorial Trees for Louisiana Highways.

Baton Rouge, La.—In memory of her sons who gave their lives in the war, Louisiana is planning to plant 440 miles of "victory oaks" and other suitable trees along Jefferson Highway, the state's principal road which runs from north to south and connects with the highway that extends all the way on to Winnipeg, Canada. The plan advocated by the American Forestry Association has been approved by Governor Pleasant, who declares that "no more fitting memorial could be reared to our soldiers, dead and living." The details of the memorial have been turned over by him to M. L. Alexander, head of the Department of Conservation. The trees will stand about forty feet apart. Oaks will be used wherever possible, although in some parts of the state other trees will thrive better.

SEWERAGE AND SANITATION

Great Death Rate Increase Due to Influenza.

Washington, D. C.—The recent influenza epidemic caused 111,688 deaths in the forty-six largest cities and increased the combined death rate for those communities in 1918 to 19.6 per thousand, according to statistics made public by the Census Bureau. Total figures for the country were not available. Baltimore, with 26.8 per thousand, and Nashville, with 26.4, had the highest rates of registration cities, while St. Paul, with 13.9, and Minneapolis and Grand Rapids, with 14 each, had the lowest. Grand Rapids showed the smallest increase, the death rate for 1917 having been 13.1. There were 442,374 deaths in the forty-six cities, the estimated population of forty-two of which aggregated 20,514,520. There was no estimate of population for the other four.

Deaths from influenza totaled 69,439, with 42,149 deaths from pneumonia. The year's total death rate in New York City was 13.8 per thousand, compared with 15.2 for 1917. In Chicago it was 17.1, against 14.9 the year before, and in Philadelphia, where the influenza epidemic was very severe, it was 24.2 compared with 17.1 in 1917. The rate in Cleveland was 16.0 for last year and 13.9 in 1917, Boston 22.0 and 16.4, St. Louis 17.6 and 15.1, Pittsburgh 25.4 and 18.2, and Los Angeles 16.4 and 12.5. In San Francisco the rate was 20.5, compared with 15.0 for 1917, in Buffalo 21.2 and 16.4, Milwaukee 14.4 and 12.8, Newark, N. J., 19.5 and 14.2, Cincinnati 20.6 and 16.5, Washington 23.6 and 16.8.

Typhoid Fever Epidemic Spreading.

Huntingdon, Pa.—A typhoid fever epidemic here is fast assuming serious proportions, and fifty-five cases have been reported to the office of the state department of health. Dr. B. Franklin Royer, acting commissioner of health, said that additional evidence is accumulating against the water supply of Huntingdon. Seven out of fourteen of the first samples of water collected by the department of health's sanitary engineers indicate colon bacillus.

$35,000 to Fight Influenza.

Los Angeles, Cal.—The city council has voted to appropriate $35,000 to be used by Dr. L. M. Powers, city health commissioner, to combat influenza. The council voted to place no restrictions upon his use of the money. Dr. Powers and a special business men's committee made the request for the appropriation after a conference in the office of mayor Woodman. There have been 40 inspectors at work, and due to their efforts, Dr. Powers said, the quarantine is more effective. He attributed the decrease in the number of cases to this fact, and the fact that the schools had been closed again. Ninety more inspectors were put to work.

STREET LIGHTING AND POWER

Greater Interconnections of Coast Power Systems.

San Francisco, Cal.—Following proposals by Major George F. Sever, Pacific Coast representative of the Power Section of the War Industries Board, a committee of engineering representatives of three power companies centering at San Francisco have held a series of meetings to consider additional interconnections between their transmission systems. At the conferences the Pacific Gas & Electric Company was represented by F. G. Baum and P. M. Downing, the Sierra & San Francisco Power Company by J. E. Woodbridge, and the Great Western Power Company by W. G. B. Euler. In the discussions the three properties were considered as one system and a study was made of the possible advantages to the entire network to be expected from further interconnections. Between the Pacific and Great Western systems and between the Sierra and Great Western systems no further interconnections were justified, it was agreed. Between the Pacific and Sierra systems, however, another interconnection between the high-voltage network near the south end of San Francisco Bay was found desirable and was recommended. The Port Marion substation of the Sierra company would ultimately be the better transmission center it was agreed, for the various lines radiating from the south end of the bay. For the present, however, the best plan would be for the Pacific company temporarily to terminate its 100,000-volt line at Mission San José and step down to 50,000 volts at that point. Then a 100,000-volt branch about a mile long should be built from Mission San José to connect with the main line of the Sierra system. The Sierra company at this part of its system operates at about 105,000 volts, varying between 102,000 and 108,000 volts. It was the opinion of Pacific company representatives that its voltage could be brought within the same range, making unnecessary any voltage-varying devices especially for interconnection purposes. The committee agreed that this interconnection would have "the following inherent advantages that will prove of value to both companies": (1) A greater utilization of the hydroelectric energy that may be available at any time of the year, making it possible to combine the steam plant standby service better, at least during a certain part of daily and yearly operation. (2) Improvement in the daily and seasonal load factor and power factor of the two systems as a whole, thus utilizing to better advantage the plant and transmission capacities of the systems. (3) Adding an insurance feature to the service and thus reducing the capital charge of the individual companies for this purpose. It was also thought that at some future time a consolidated substation at the south end of the bay would result in a reduction of capital and operation cost and in more effective operation.

Commission Declares Plant Inefficient.

Lamar, Colo.—In authorizing the Intermountain Railway, Light & Power Company to increase electric rates in Lamar the Colorado Public Utilities Commission says in its decision: "The Lamar plant of the Intermountain Railway, Light & Power Company is a very inefficient one, the coal consumption being in excess of 16 lb. of bituminous coal per kilowatt-hour of output. While it is fully realized that this condition cannot be corrected at this time on account of the difficulty in securing equipment, the company is not entitled to any reward for efficient operation in the disposition of this case. The cost of steam-power plant generation alone for the year 1917 was 70 per cent of the operating revenues for that period, and this ratio will probably be increased for the year 1918. There is also a very high unaccounted-for loss in distribution, which, in the opinion of the commission, does not result largely from leakage through trees, as stated in testimony. The serious problem before the commission, the company and the citizens of Lamar is that of providing sufficient revenue to enable the company to meet operating expenses necessarily incurred. It would be idle at this time to discuss the proposition of providing more efficient equipment for the purpose of reducing operating expenses. Such equipment, even if available, has so advanced in price that its substitution for the present equipment, even if obtainable, might not be desirable on account of the increase in fixed charges which would result. The commission is of the opinion that the rates of the applicant are unremunerative under the conditions prevailing at this time."

WATER SUPPLY

City Buys Water Works.

Ashland, Ky.—The city has purchased the plant of the Ashland Waterworks Company for $356,000. This action ends a suit as to ownership which has been fought through the various courts for the past ten years.

Condemnation Proceedings to Increase Supply.

Bayonne, N. J.—Condemnation proceedings to increase Bayonne's water supply have been sanctioned by the city commissioners. As a result the amount of water to be supplied the city daily will be increased by four million gallons a day up to 1920 and by five millions daily after that date. Resolutions adopted on Jan. 18, 1916, called for 16,000,000 daily until 1920, 20,000,000 daily from 1920 to 1925 and 25,000,000 gallons daily from 1925 to 1930. The latest resolution changed the amount to 20,000,000 gallons until 1920 and 25,000,000 per day thereafter. The resolutions also called on the East Jersey Water Company to pay the city of Bayonne each quarter its share of the cost of the water diverted.

West Orange, N. J.—This city has received notice that it would be unable to secure its supply of water from the Commonwealth Water Company because of an injunction secured against the company by the Weidmann Soap and Dyeing Company of Paterson. The company secured the injunction against the water company to restrain it from diverting water from the Passaic River above Little Falls. The injunction affects Paterson, Bloomfield, Rutherford, Glen Ridge, West Orange, Bayonne and Jersey City. The

only relief for these communities is to institute condemnation proceedings. They had until Jan. 9 to act before their water supply was to be cut off.

FIRE AND POLICE

Firemen Install Eight-Hour Day Themselves.

Cleveland, O.—Two-thirds of the fire department force of 585 men went off duty as a result of the Firemen's Union's plan to institute an eight-hour working schedule. The amendment to the city charter granting the firemen and policemen an eight-hour day was approved by the voters in 1917. It was never enforced, city administration officials say, because of lack of finances. One hundred and ninety members—one-third of the department—left their posts at midnight. Another one-third walked out at 8 o'clock next morning. The remainder were relieved at 4 o'clock in the afternoon by the first unit, which remained on duty until midnight, when the second group relieved them. According to union officials, all the firemen will report in any great emergency. Mayor Davis issued a statement saying that "the city will fill as soon as possible the vacancies of those who have voluntarily taken it upon themselves to leave their post of duty." Discharged soldiers and sailors and men out of employment were appealed to take their places.

To Systematize Firemen's Pensions.

Trenton, N. J.—The Pierson Pension Commission has given a hearing on the firemen's pension fund in order to enact the best legislation possible in the interest of firemen's pensions. Chairman Arthur N. Pierson explained to about fifty representatives of the firemen's pension fund that two years ago the Legislature found that there was a tremendous flood of pension amendments to existing systems, and it was thought that it was time to look into the matter in a systematic way. He explained a proposed pension bill providing for the establishment of municipal pension funds and their central supervision through a state commission.

Climbs Through Fire to Save Flag.

New York, N. Y.—Alfred Hovorka, driver of Engine 32, at a recent fire climbed through a circle of fire to the tip of a flagpole and saved the American flag from being destroyed by the flames. A big crowd, gathered to watch the fire, cheered and applauded the fireman's act. Before the fire was out, four offices on the third and fourth floors of the building had been burned out, with damage estimated at $10,000.

GOVERNMENT AND FINANCE

May Sue State in Its Own Courts.

Columbus, Ohio.—Ohio Supreme Court decrees holding that a state constitutional amendment permitting suits against that state in its own courts is not effective without legislation have been in effect sustained by the U. S. Supreme Court at Washington. The court dismissed proceedings brought to recover damages resulting from the construction by the Ohio board of public works of a reservoir in Mercer county.

Reconstruction Plans of St. Louis.

St. Louis, Mo.—The City Plan Commission has published a pamphlet entitled "St. Louis After the War," containing the results of investigations of public improvements totaling $93,972,000. These do not include transit or housing. Estimates made by city department heads, presumably with a view to the more immediate needs of the city, total about $34,000,000. The available borrowing capacity of the city, under a 5 per cent bond limit, is $23,500,000. The City Plan Committee of the Chamber of Commerce, with a membership of 75, recently voted in favor of $22,000,000 bond issue. Mayor Kiel has appointed a citizens' committee of 25 members to act with city officials in canvassing the whole situation. This committee includes a number of architects and engineers and has as chairman John L. Mauran, president of the American Institute of Architects. The $34,000,000 estimate made by department heads is as follows:

Improvement of River des Peres	$11,780,000
Repair and construction of sewers	5,655,000
Parks and playgrounds	6,005,500
Municipal convention hall	2,500,000
Municipal farm	700,000
Robert Koch Hospital improvements	200,000
Municipal railroad and docks	2,100,000
Elimination of grade crossings	3,142,200
City's share of street openings	600,000
Garbage reduction plant	550,000
Department of Streets and Sewers	450,000
New fire engine houses and equipment	400,000
Municipal garage	125,000
Additional cells in city jail	100,000
Total	$34,227,700

These items agree in a general way with the estimates of the City Plan Commission for the same objects. In addition, the commission put down $25,000,000 for river-front improvements, $20,000,000 for water-works, and $15,000,000 for public buildings and a group plan. The water-works extension may be financed outside the bond limit.

Mayor Gets $12,000 Gift.

New Bedford, Mass.—Mayor Charles S. Ashley, who on Jan. 1 was inaugurated for his twentieth term, was the recipient of a purse of $12,000. The presentation was made on behalf of eighty manufacturers and merchants in appreciation of the mayor's long service to the city.

Sewer Work Held Up by Bond Firm.

Detroit, Mich.—Refusal of Merrill, Oldham & Co., bond brokers, of Boston, to purchase $988,700 worth of Detroit sewer bonds for which they were high bidders, may tie up almost the entire 1919 sewer program. The main part of the work was to be the Third street sewer, construction of which was to have begun at once, in order that the outlet might be completed before navigation opened. The Boston company, through its attorneys, Storey, Thorndike, Palmer & Dodge, has notified city controller Engel that it considered the proposed bonds invalid, as they were not approved by a three-fifths vote of the people, as provided in the charter. Mr. Engel, in an informal opinion, told the ways and means committee of council he thought they were valid and it is probable that a settlement of the question will have to be made in the courts. H. H. Esselstyn, commissioner of public works, told the committee the work must be done at once at any cost and that the contractors, J. A. Mercier and George Cooke, were willing to finance the work themselves if they were given proper guarantees the money would be paid. But it was pointed out the city could not guarantee more than 7½ per cent of the amount, this being the limit the municipality is permitted to borrow in advance of a bond issue. It was the Merrill-Oldham company bid on these bonds which caused much comment several weeks ago. The company, after making a sealed proposal, telegraphed an additional offer of $10 a bond, and when the bids were opened it was found the company would have been high bidder without this extra. The telegram thus cost the company $9,887.

TRAFFIC AND TRANSPORATION

Court Decides Commission Has Fare Raise Power.

St. Louis, Mo.—The state supreme court has handed down a decision in the 6-cent fare case of the United Railway which upholds the raise in rate awarded by the public service commission. In an opinion written by judge A. M. Woodson the court reversed and remanded the decision of circuit judge J. G. Slate of the Cole county circuit court, who held that the commission was without jurisdiction to grant the increased fare. Judge Woodson held that Sec. 20 of Art. XII. of the State Constitution, on which city counselor Daues relied chiefly in his opposition to the fare increase, did not apply. Mr. Daues contended that under this section the state could not take away the

power from the city to regulate the rates of a railway fixed by franchise ordinance. The 6-cent fare became effective last June, after the United Railways had asked permission to increase rates to meet the demands of employees who had walked out on strike in February. Chairman W. G. Busby of the commission wrote the opinion granting the fare increase, and it was concurred in by commissioners Noah Simpson and Edward Flad. Commissioners David W. Blair and E. J. Bean dissented on the question of jurisdiction. Proceedings were started in the Cole county circuit court by counselor Daues for the city of St. Louis to upset the fare increase. When circuit judge Slate held the commission was without jurisdiction, the railway appealed to the supreme court. Chief justice Bond then granted an order permitting the company to continue to collect the extra 1-cent fare, which he directed to be impounded until the final determination of the case.

Towns Subsidize Street Railway.

Great Barrington, Mass.—The towns of Great Barrington, Sheffield and Egremont have taken advantage of the legislative act of 1918, which permits municipalities to give aid from their treasuries to electric railways and have made appropriations for the assistance of the Berkshire Street Railway. Their action is said to be without precedent in the commonwealth.

CITY PLANNING AND HOUSING

U. S. Shipping Board Asks Co-operation in Port Development.

Washington, D. C.—E. F. Carry, chairman of the Port and Harbor Facilities Commission of the United States Shipping Board, has sent a letter to the officials of cities so located as to permit of port developments. In outlining the scope of the program to be pursued by the Port and Harbor Facilities Commission, Mr. Carry asserts that one of the most essential requisites to the upbuilding of the maritime commerce of the United States is the establishment of a national zoning system under which the exports and imports of the country will flow through those ports that are within economic transportation distance of the points of origin and destination. He says in part: "The markets of the world offer unprecedented opportunities for the exportation of American products. The United States Shipping Board is rapidly producing the ships to carry those products. There is urgent need, however, for extensive improvements in many departments of our maritime commerce. There must be a great increase in the number of dry docks; new methods must be adopted to increase the efficiency of available port and harbor handling appliances; the most improved modern equipment must be substituted as rapidly as possible for much now in use, and additional facilities must be provided where needed; there must be perfect co-ordination between the shipping interests of every port in order that the tonnage of our merchant marine may be utilized to the limit of its capacity; and the congestion of traffic in some of our ports must be relieved by a systematic and economical distribution of exports and imports. A careful study of these problems has convinced the Port and Harbor Facilities Commission that one of the most essential requisites to the upbuilding of the maritime commerce of the United States is the establishment of a national zoning system under which the exports and imports of the country will flow through those ports that aee within economic transportation distance of the points of origin and destination. Investigations made by the commission in co-operation with the United States Railroad Administration demonstrate that such a system is not only practicable, but that its adoption will facilitate the general movement of the freight as well as stimulate and expedite the maritime commerce of the country.

"The success or failure of the Port and Harbor Facilities Commission in the work it has undertaken depends upon its ability to obtain the co-operation of those state and municipal authorities whose cities front upon our coasts, and of every commercial and industrial enterprise engaged in the export and import trade. This is especially true of those improvements and extensions that must be made in the equipment of its ports and harbors if the United States is to play a part in the maritime commerce of the world commensurate with the position it now holds among nations.

"The impression prevails that the United States Shipping Board will finance port and harbor improvements. That impression is erroneous. Such improvements must be made through private or public enterprise. The Port and Harbor Facilities Commission will render every assistance within its power to improve the facilities and promote the business of every port and harbor of the United States. Its investigations are being made with that end in view and its energies are being concentrated upon the expeditious accomplishment of that object. It firmly believes, however, that the best guaranty of success of a port lies in the investment in port and harbor improvements by those interested in the industrial commercial activities of the territory naturally tributary to the port. The commission is convinced that both local and national interests will best be served by the appointment of a port commission for every port on our coasts at which there is no such commission at present, and by confering upon existing commissions such additional authority as may be necessary to co-operate all municipal, industrial, commercial and railroad interests centering at such ports.

"The commission bespeaks your active co-operation in putting this plan into effect at the earliest possible moment.

"It is our desire and purpose to keep in constant touch with every port commission, and we shall be obliged if you will inform us of the personnel of the commission at the first opportunity. The data collected by this commission and the advice and assistance of its experts will always be at the disposal of the local commissions.

"In this connection the commission urges that it be consulted in regard to all improvements of port and harbor facilities, and that the plans for such improvements be submitted in order that adequate facilities be assured at every port.

"We shall be glad to receive any expression of your views on the subject to which we have referred, especially in regard to the local commission, and we shall be greatly obliged if you will communicate with us at your earliest convenience."

Unfinished Government Housing Would Be Loss.

Washington, D. C.—Suspension of work on all Government housing projects not 75 per cent complete, as threatened in a resolution passed by the United States Senate and now before the House of Representatives for action, will cause the loss of millions of dollars, according to a statement by Lawrence Veiller, secretary of the National Housing Association. The resolution has been adopted by the Senate, upon the ground that it would save money to the taxpayers of the country. "The officials of the United States Housing Corporation of the Department of Labor, which has the projects in charge, and the directors of the National Housing Association, a disinterested body of housing experts, however," says the statement, "point to the depreciation from physical causes which must inevitably result to the large number of unfinished houses from their indefinite exposure to the elements in an unfinished state, and to the complications and losses which would result from a wholesale cancellation of contracts as sufficient argument that no such saving would result from the proposed action, but that, on the contrary, millions of dollars would be lost, which, on completed buildings might readily be salvaged. Neither the officials of the Housing Corporation nor the directors of the National Housing Association are advocating permanent Government ownership of these houses, nor a continuation of the Government in the housing business. They merely urge that any action taken by Congress at this critical time be based upon a more thorough-going investigation than has yet been accorded the matter. Should the resolution, in the form in which it passed the Senate, pass also the House, a state bordering on havoc would be created." The National Housing Association is making an effort to have the Senate resolution killed in the House of Representatives. The resolution now is in the hands of the House Committee on Building and Grounds, of which Representative Frank Clark of Florida, is chairman.

NEWS OF THE SOCIETIES

Jan. 13.—AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Annual meeting, New York City. Deputy secretary, B. Etchelle, 35 Nassau St., New York City.

Feb. 18-21, 1919.—AMERICAN ROAD BUILDERS' ASSOCIATION. Sixteenth annual convention and Ninth American Good Roads Congress under the auspices of the A. R. B. A., Hotel McAlpin, New York, N. Y. Secretary, E. L. Powers, 150 Nassau street, New York, N. Y.

Nov. 12-14, 1919.—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention, New Orleans, La. Secretary, Charles C. Brown, Bloomington, Ill.

Governors' Conference.

Two-thirds of the states in the Union were represented by governors and governors-elect at the recent governors' conference held at Annapolis, Md. Little of direct interest to municipalities was brought out, although a number of large national problems of concern to the cities were discussed. Cabinet Secretaries Baker, Houston, Daniels, Lane and Wilson addressed the delegates.

Governor Harrington, who acted as official host in behalf of Maryland, opened the conference with an address of welcome, and the response was by Governor Manning of South Carolina.

Secretary Baker said that the war had proved the indispensability of strong state governments, in peace as well as war time, as the principal agencies for mobilizing and demobilizing armies, finding work for returning soldiers, and developing better methods of physical training for young men. At the same time he pleaded that state authorities give cities more freedom to work out their individual local problems.

The War Secretary emphasized that one of the principal functions of states hereafter must be "to rescue young men from the situation shown during the recent mobilization, when one-third of the drafted men were found to be physically undeveloped or defective."

Governor Harrington of Maryland said: "The surest way to avoid socialism or anarchy is to have forms of government and legislation that give equal and just rights and equal and just opportunity to every citizen. Public utility corporations and big business must now understand that they can only exist when they recognize that their existence is permitted only for service and not for self, and that they are servants and not masters."

National Highways Association—Bridge Division.

Recent measures taken to organize a committee of bridge engineers as a Division of Bridges of the National Highways Association are to be continued at a meeting of the committee January 17 in New York City. A tentative outline of the program of work which this committee will undertake includes consideration of the subject of highway crossings over large rivers, advice and assistance in the broader preliminaries of highway bridge projects, and related matters in which special knowledge of bridge engineering may be made of service to highway development. The division will carry on its work on the principle of taking the initiative in any particular case only when called upon to do so. The functions of the committee are planned exclusively for service to the public good. Further development of the program of future work is expected to come about through the meeting on January 17. G. Lindenthal is chairman of the division, and C. E. Fowler is secretary.

American Society of Civil Engineers.

The Committee on Developments of the American Society of Civil Engineers, at its recent meeting in Chicago, decided to divide its work into four principal groups, appointing a subcommittee for each group. The committee also passed resolutions outlining future work, including recommendations that the society adopt the principle of becoming an active force in national affairs; that the importance of engineering in the reconstruction period should be brought forward nationally, and that the subjects assigned to the subcommittees should be discussed at the annual meeting of the society in January.

An executive committee was appointed, consisting of the following members: Onward Bates, chairman; Baxter L. Brown, W. L. Darling, H. L. Haehl, E. S. Nethercut, Frederick C. Noble and H. R. Safford.

The four divisions of work assigned to the subcommittees are:

Technical Activities, including (1) meetings, papers, and committee work; (2) sections or divisions of the society for specialized lines of work; (3) cooperation with specialized engineering societies and other organizations, and (4) standards in engineering practice.

Internal Relations and Local Associations, including relations with (1) local associations; (2) cooperation between the society's local associations and those of other national societies and local societies; (3) rearrangement of the grades of membership; (4) student engineers; (5) young men of the profession, and (6) personal service bureau.

External Relations with the Engineering Profession, including relations (1) with other national societies and related organizations; (2) with local societies other than the relations referred to above; (3) amalgamation of engineering societies, and (4) American engineers in foreign service.

Relations to Public Affairs, including (1) professional status of the engineer; (2) legal status of the engineer, and (3) public status of the engineer.

Committee on technical activities: Robert A. Cummings, chairman, and George R. Putnam. The chairman of this subcommittee was authorized to name three other members.

Committee on internal relations and local associations: Frederick C. Noble, chairman; Richard L. Humphrey, George G. Anderson, Edgar S. Nethercut, Gardner S. Williams, Clifford M. Holland, H. L. Haehl, George C. Mason and J. H. Brillhart.

Committee on external relations with the engineering profession: S. Everett Tinkham, chairman; Thomas L. Wilkinson, E. B. Thomas, William H. Hoyt, Arsene Perrilliat, H. R. Safford, and Arthur Pew.

Committee on relations to public affairs: W. L. Darling, chairman; J. C. Ralston, Charles Hansel, George Butler, Frank T. Darrow, C. J. Tilden, John L. Hall, B. L. Brown and Paul G. Brown. This subcommittee may appoint its own divisions.

It is the intention that the subcommittees shall analyze and study the available data and information, and the recommendations of these subcommittees will be considered by the Committee on Development.

The committee will keep in close touch with the work of similar committees of the other national engineering societies, and will endeavor so to co-ordinate its work as to be, as nearly as practicable, in harmony with their action on related matters of common interest. The committee will thereafter submit its final report with its recommendations.

United States Good Roads Association.

The seventh annual convention of the United States Good Roads Association will be held April 14-19, 1919, at Mineral Wells, Texas.

American Institute of Consulting Engineers.

A meeting is to be held on January 13 by the American Institute of Consulting Engineers. The subject to be considered will be "The War and Reconstruction."

New York State Tax Association.

The eighth conference on taxation and the meeting of all assessors in New York State is announced for January 22, 23 and 24 in Albany under the joint auspices of the State Tax Commission and of the State Tax Association. At the opening session addresses of welcome will be delivered by governor Alfred E. Smith and mayor James R. Watt of Albany. Professor Edwin R. A. Seligman also will speak.

Ohio Road Congress.

The second annual session of the Ohio Road Congress will be held at Columbus, O., January 14, 15 and 16.

At this time will be held the regular annual meetings of the Ohio Good Roads Federation, the Ohio Engineering Society and the County Commissioners' Association of Ohio. The congress will have the co-operation of the state highway and agricultural departments, the State University, the State Grange, the postmasters of the state, the local chambers of commerce, the State Highways Transport Committee of the Council of National Defense, the Ohio State Automobile Association, the Ohio Contractors' Association, the Ohio Auto Trades Association, the Ohio Paving Brick Manufacturers' Association, the Ohio Macadam Association, the Ohio Sand and Gravel Association and the Portland Cement Association.

The state legislative program dealing with highways will receive particular attention.

INDUSTRIAL NEWS

Iron and Steel.—The pig iron market has experienced a general decline of $3 a ton. The decline is to be viewed in connection with the schedule of iron and steel price reductions which the committee of the American Iron and Steel Institute had prepared for submission to the Committee of the War Industries Board at the meeting of December 11, but which the committee of the board refused to consider, as it did not intend to indulge in further price fixing. The steel trade immediately adopted the suggested reductions in steel products, but the merchant blast furnaces held off, and only in the last few days have they reduced their quotations.

The whole iron and steel market is in an extremely quiet condition. Producers see no indication that the market will become active in the near future, and rather look for a dull market for three months or thereabout. There is a moderate amount of specifying on old contracts, but scarcely any strictly new business.

New construction of steel-making capacity in the United States in the last year has amounted to a shade less than 2,000,000 tons of rated capacity in ingots. The total new construction since the war started in 1914 amounts to nearly 11,000,000 tons of rated capacity, probably equal to the actual production of 10,000,000 tons, and the total steel-making capacity of the United States, including steel castings, is nearly 50,000,000 tons. This is about one-half greater than the actual production in any calendar year prior to the war. During 1918 production was restricted by various influences, and the actual production was only about 42,000,000 tons, with somewhat more than a million tons of steel castings in addition.

With very few exceptions all the iron and steel pipe mills have issued their new discount cards showing a three-point reduction in prices, and they are all dated January 1, 1919. The new cards cover steel pipe, iron pipe and steel boiler tubes. The new basing discount on standard steel pipe is 54 per cent., this applying on three-quarters to three-inch butt weld.

Keen interest was aroused in the steel trade by the announcement of the Department of Justice that as all price control would end December 31 sellers who should thereafter undertake to fix prices, even reduced prices, would have the attention of the department. It was the announcement rather than the principle involved that attracted attention. While the steel industry was not mentioned in the statement, there is a disposition to couple the department's disapproval of "concerted" price changes, even if they are reductions, with the fact that less than three weeks before the steel industry had made price reductions that were both general and specific, even though they may not have been concerted. In the iron and steel trade there has been a hope that the custom of quarterly price fixing might be continued in one form or another, and it had already been suggested, prior to the attempt to have the War Industries Board fix prices for the first quarter of 1919, that some plan might be devised whereby, when the quarter ended, a fresh schedule for the second quarter might possibly be promulgated to the trade at large with the connivance or assistance of some department of the Government. The Department of Commerce had even been suggested in this connection, also the Department of Labor.

American Wood Preservers' Association.

The fifteenth annual meeting of the American Wood Preservers' Association is to be held in St. Louis January 28-29. On the following two days a meeting of the tie producers of the country, to effect a national organization, will be held under the auspices of the tie and timber division, St. Louis Chamber of Commerce, in order to bring together both producers and users of cross ties.

In order to fit together the programs of the two bodies the meeting of the American Wood Preservers' Association has been curtailed to two days, with three sessions on the first day and two on the second, concluding with a joint dinner with the National Tie Producers' Association. A session on the first day of the meeting will be devoted to consideration of the preservative materials situation, and a session on the second day to the tie problem.

Walter A. Zelnicker Supply Co., 325 Locust street, St. Louis, Mo., in its January, 1919, bulletin (No. 250), offers a large line of construction equipment. The list ranges from marking crayons and spikes to 91-ton locomotives and to power plants. It includes attractive bargains in cranes, cars, dump cars, steam shovels, air compressors, boilers, car loaders, condensers, drills, elevators, engines (gas, gasoline and steam), generators, motors, pipe cutting and threading machines, pumps, sand dryers, buckets, concrete mixers, forms, conveyors, crushers, derricks, drag lines, graders, hoisting engines, pipe, trenching machines, road rollers, tanks, etc.

Material-Handling Machinery Manufacturers.

At a recent conference of committees representing material-handling machinery manufacturers held in New York for the purpose of considering ways and means for improving cargo handling at ports of the United States in conjunction with the Port and Harbor Facilities Commission of the United States Shipping Board, steps were taken to make permanent the organization of what will be known as the Committee of Material-Handling Machinery Manufacturers' Associations. This new body will comprise four groups of manufacturers, represented by the following committees:

Class 1—Trucks, Tractors and Trailers: F. W. Conlin, the Crescent Truck Co., 30 Church street, New York, chairman; L. C. Brown, the Elwell-Parker Electric Co., 50 Church street, New York; R. P. Kennedy, the Baker R. & L. Co., New York.

Class 2—Gravity and Power Conveyor Apparatus: B. H. Alvey, the Lamson Co., chairman, Boston, Mass.; F. E. Moore, the Mathews Gravity Carrier Co., Elwood City, Pa.; E. R. Humphrey, the Link-Belt Co., Philadelphia.

Class 3—Cranes, Hoists and Winches: J. A. Shepard, the Shepard Elec. Crane & Hoist Co., Montour Falls, N. Y.; L. H. Libby, the Sprague Electric Works, Bloomfield, N. J., and member Electric Hoist Manufacturers' Association; H. W. Davis, the American Hoist & Derrick Co., St. Paul, Minn.

Class 4—Elevators: R. W. Scott, the Otis Elevator Co., Thirty-sixth street and Eleventh avenue, New York; D. V. Jenkins, the Watson Elevator Co., 407 West Thirty-sixth street, New York, and member Elevator Manufacturing Association of New York; O. P. Cummings, the A. B. See Electric Elevator Co., 220 Broadway, New York, and member Elevator Manufacturers' Association of the United States.

PERSONALS

Governor William C. Sproul of Pennsylvania has appointed Dr. Edward Martin of Philadelphia state commissioner of health and Colonel Louis S. Sadler, Carlisle, state highway commissioner.

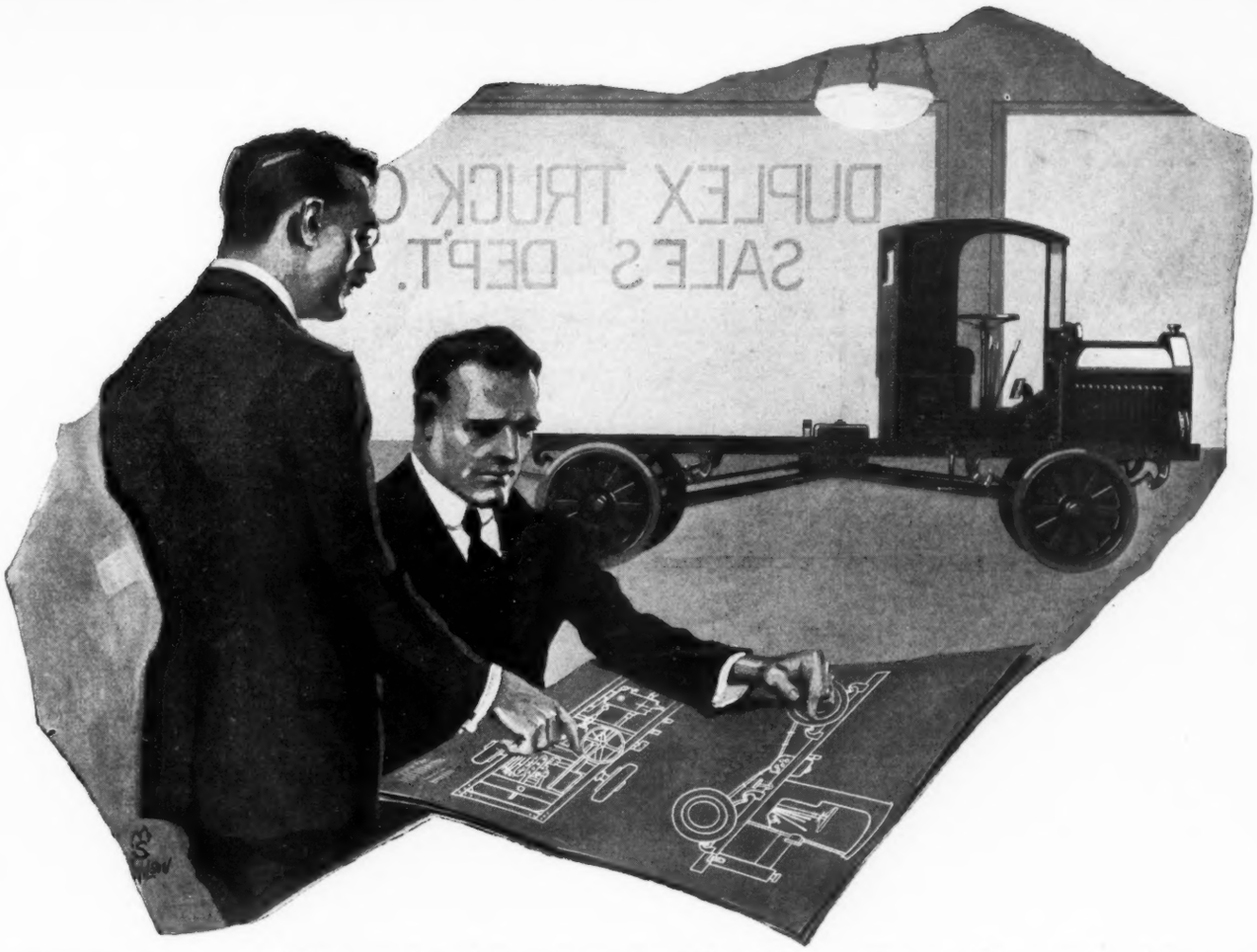
Connolly, Frank A., has been chosen by unanimous vote of the city commission of New Brunswick, N. J., as commissioner to take the place of mayor Edward F. Farrington, who died recently. Commissioner John J. Morrison was appointed mayor.

Landreth, William B., has been named chief of the board of consulting engineers, New York State Canal System, succeeding Joseph Ripley. Mr. Landreth has been connected with the canal system of the state for many years and has served as deputy state engineer during the administrations of State Engineer Williams.

Hughes, T. C., Tulsa, Okla., has been appointed consulting engineer to supervise the construction of hard-surfaced roads to be built by Tulsa County under the $1,700,000 bond issue voted last year. He will co-operate with D. W. Patton, county engineer, who will be engineer of construction.

Roper, Roswell M., for the past year acting engineer for the water department, East Orange, N. J., has been appointed engineer of the department

Chapin, Roy D., chairman of the Highways Transport Committee of the Council of National Defense, has resigned. Mr. Chapin, who is president of the Hudson Motor Car Company, returns to his business in Detroit after a year's service in Washington helping the Government energize the highways of the country and increase the flow of commodities over them. The work of the Highways Transport Committee will be taken up by John S. Cravens, chief of the Field Division, Council of National Defense.



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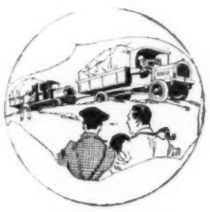
ORIGINAL
4 WHEEL DRIVE

12TH YEAR



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